

ROADS AND STREETS

HIGHWAYS BRIDGES
AIRFIELDS
HEAVY CONSTRUCTION

MAY 1950



How to make a grader's front wheels last

The front wheels of a grader run into some rough going . . . but if they're equipped with Timken bearings they can take it. That's why the Galion Iron Works and Manufacturing Company specifies Timken bearings for all their motor graders. Timken bearings reduce friction and wear, help prevent breakdowns, keep maintenance to a minimum.

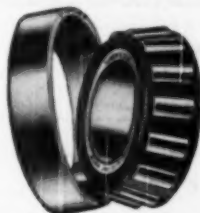
Due to their tapered construction, Timken bearings take radial and thrust loads in any combination. Their true-rolling motion and incredibly smooth surface finish

enable them to operate freely and almost frictionlessly. Line contact between the rolls and races provides extra load-carrying capacity under even the toughest loads.

No other bearing can give you *all* the advantages you get with

Timken bearings. Use them in the machinery you build—look for them in the machines you buy. Be sure the trade-mark "Timken" is on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN
TRADE MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



FIRST CHOICE FOR POWER*



Ford
INDUSTRIAL ENGINES



Ford "254" Power Unit
8 cylinder; 254 cu. in. displacement
(also available in open type power unit
or engine assembly only)

More and more leading equipment builders are making Ford Industrial Engines and Power Units their "first choice" power sources. Makers of agricultural machinery... air compressors... derricks and hoists... lumber and sawmill equipment... pumps... road and construction machinery and the like have made Ford Power standard equipment on their products because it's the power that's right 3 important ways.

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are offered as complete power units or as individual units, either open or closed, both with a wide variety of special attachments. They are made in the following types and sizes:

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INDUSTRIAL ENGINE DEPT., FORD MOTOR COMPANY, DEARBORN, MICHIGAN

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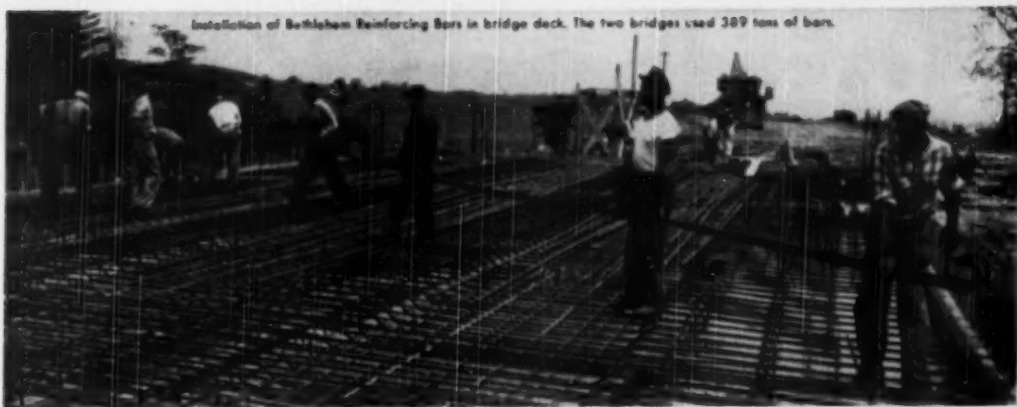
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Industrial Engine Department
FORD MOTOR COMPANY
Dearborn, Michigan



Installation of Bethlehem Reinforcing Bars in bridge deck. The two bridges used 389 tons of bars.

Improving a Highway in Eastern Pennsylvania



Francis C. Wagman (at left), and George A. Wagman, contractors, refer to blueprint in checking progress of job.

Continuing its highway improvement program, the Pennsylvania Department of Highways recently authorized relocation of 4913 ft of Route 24, near York, Pa. Included in the construction of the new 2-lane road were two reinforced concrete bridges. Contractor: G. A. and F. C. Wagman, Inc., Dallastown, Pa. In addition to structural steel and bridge reinforcing, Bethlehem furnished dowel units, cable guard rail, and steel posts.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

*On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
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Sheet- and H-Piling • Fabricated Structural Steel



One of two new concrete bridges in the relocation project, shown above shortly before completion, carries the two-lane highway over railroad tracks.



Bethlehem Cable Guard Rail, mounted on Bethlehem Steel Posts at bridge approach, affords constant protection to motorists using the new highway.



Crane, rigged with heavy-duty wire rope, prepares to lower boom for new load. Bethlehem Wire Rope has many uses in road construction.

When writing advertisers please mention **ROADS AND STREETS**, May, 1950

ROADS AND STREETS

May, 1950

Vol. 93

No. 5

Roads and Streets represents 58 years of continuous publishing in the highway field; combined with Engineering & Contracting and Good Roads Magazines, established in 1892

E. S. GILLETTE, Publisher

CEA

HALBERT P. GILLETTE, Editor-in-Chief

Coming Articles

For Contractors

How road contractors stay solvent. Advice from a contractor's banker.

Behind the Lines with Successful Contractors—beginning series.

Fast paving and grading runs—more "Knockin' Out the Yardage" case reports. Pier forms roused 30 to 40 times on Louisiana bridge job. Article highlights contractor's methods on deep foundation job.

Road Maintenance

How well are you mechanized? Report on the increasingly efficient use of graders, loaders, tractors and other standard units by certain agencies.

Design and Administration

What to do about heavy traffic loads. An article showing that we needn't "freeze" our road system at present wheel loads in the long-range outlook.

Bituminous Roads and Streets

Next month: soil-bituminous stabilization methods in Oklahoma . . . How one state highway department briefs its construction personnel for securing better contractor workmanship . . . Watch for other articles in this lively section.

Concrete Paving

A heavy airport slab involving sawed dummy joints . . . Refinements in Ohio's specifications and design standards . . . A Texas engineer reviews joint and other design details.

Soil Mopping

Applications and usefulness reviewed.

County Tries "Economy" Bridge

Eight bridges on farm-to-market roads were built by a Texas county recently, using standard re-usable steel and wood forms. Costs as low as \$50 a running foot for permanent concrete structures . . . to a design that might save money on thousands of similar structures and open up a market for enterprising small contractors.

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A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

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B.F. Goodrich



The Super Traction, Universal and Rock Logger Silvertowns shown at right are available in All-Nylon cord construction—ideal for tough construction projects.



ALL-NYLON tires offer terrific savings; no flex breaks, no bruise breaks, no blowouts!

You can judge for yourself the tremendous savings possible from tires that do not blow out or develop bruise and flex breaks. That's exactly the record run up by BFG ALL-NYLON tires . . . a record proved by more than 2 years' actual use by our customers. To date, not a single ALL-NYLON Silvertown has blown out or been found to have bruise or flex breaks!

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tween tread rubber and the cord body of BFG tires. Under impact, the nylon shock shield distributes and absorbs the shock; shields the cord body. And there is a double shock shield for double protection in large, off-the-road tires.

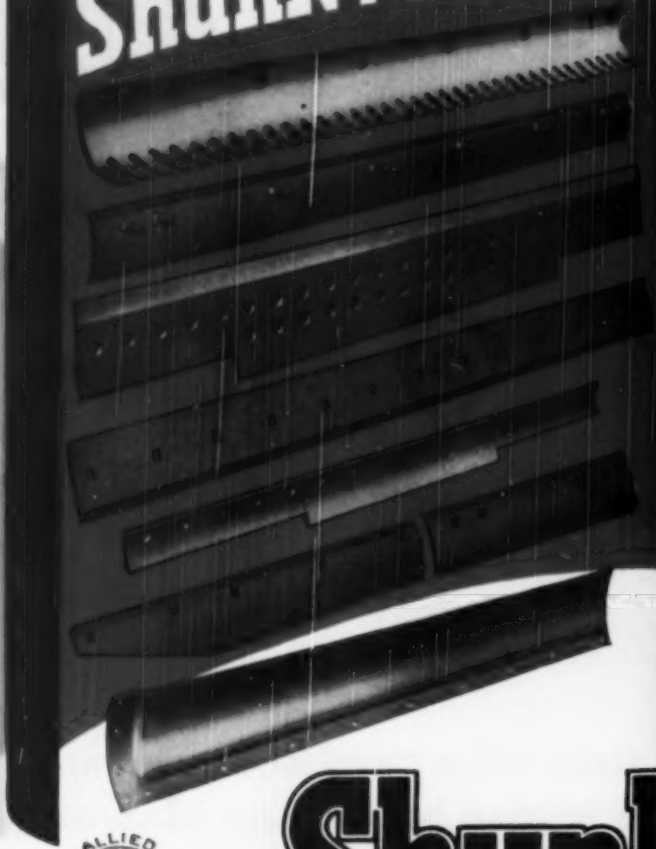
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That's putting it broadly. It's *sustained slugging power* that counts. Like the prize fighter who can stay on his feet round after round, it's the tractor which day after day can "take it and give it" that's the real profit-maker in the long run. "Caterpillar"

★ **New Mexico, near Silver City.** Two "Caterpillar" D6 Tractors push-and-pull-loading a "Caterpillar" No. 80 Scraper with 11½ yards of tough rock in a trifle over a minute—thanks to matched equipment and 130 honest drawbar horsepower. On 800-ft. one-way hauls the hauling team averaged 8 trips and 90 pay yards an hour. Total excavation (5.6 miles) 130,000 yards—about 80% rock. Two other "Caterpillar" Diesel Tractors, with Scrapers and Bulldozers, were also used on this work.

Diesel Tractors are made of that kind of stuff. They're tough! They don't need "long counts" (down time). They're quick on the comeback . . . should a new part or fix-up be in order, there's an efficient and quick-acting dealer service standing by. "Caterpillar" leaves nothing undone toward building—and keeping—60-second minutes, 60-minute hours, 24-hour days of *fighting performance* into every unit that bears its name. *Ask your "Caterpillar" dealer for the proof—in mechanical evidence, in user experiences, in demonstrations.*

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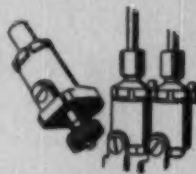
Solid Aluminum Alloy Connecting Rod and Main Bearings are exclusively "Caterpillar." Advantages: low rate of wear; fine heat-transfer characteristics; high corrosion resistance.



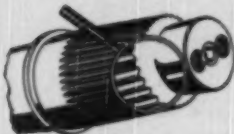
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Independent Starting Engine of exclusive "Caterpillar" design gives safe-and-sure starts at all times, and allows the Diesel to build up full oil pressure before starting.



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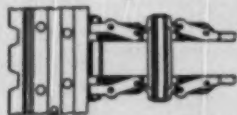
"Hi-Electro" Hardened Final Drive Gears. Teeth are three times harder after treatment and gear life is further boosted by the favorable compressive stress this process supplies.



Bellows Seals are self-aligning, self-adjusting and self-lubricating—keep oil in, dirt and water out without need for take-up adjustment or periodic attention.



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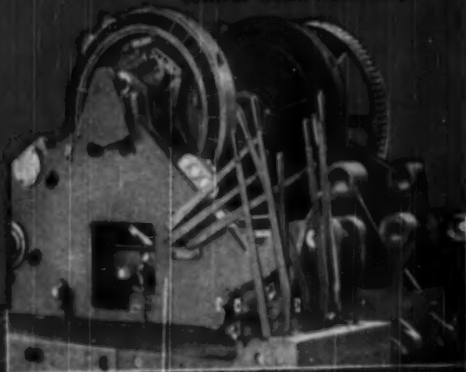
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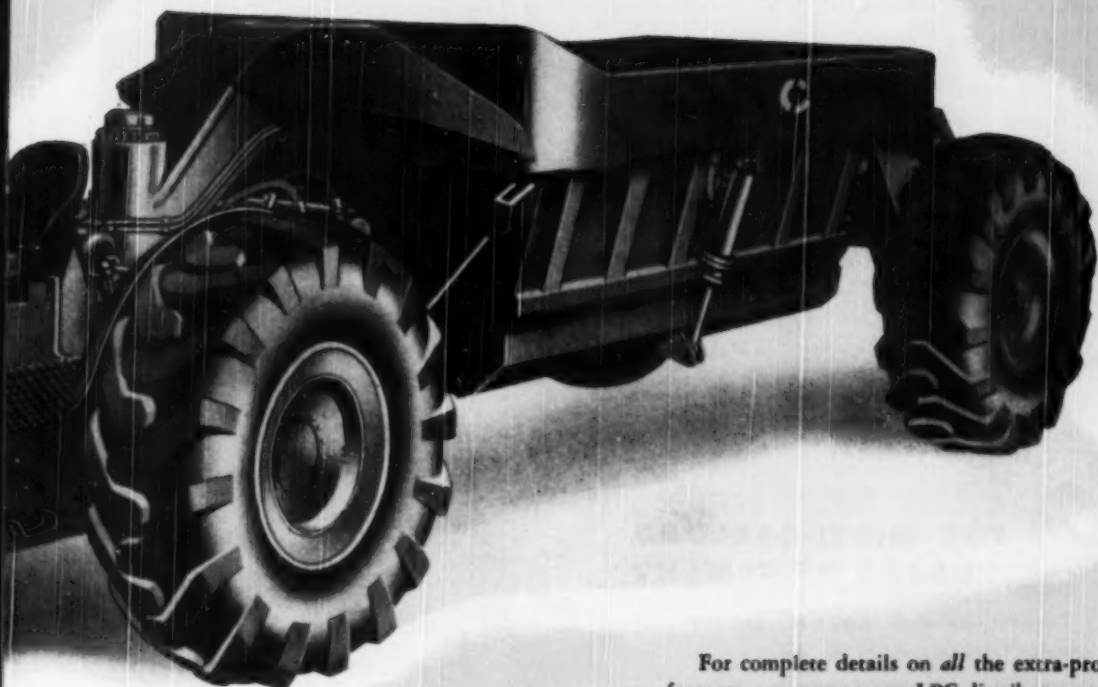


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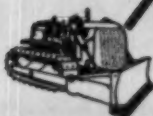
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"We doubled tonnage...cut rock delivery costs about 33%"—SAYS H. B. GRAHAM, PUEBLO, COLORADO

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the Inside Story

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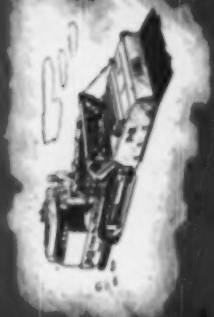


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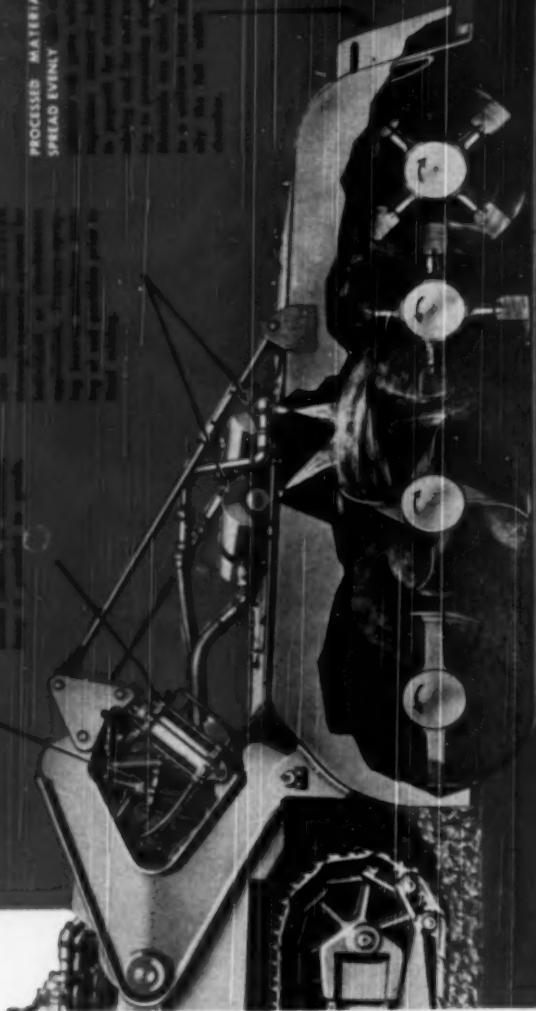
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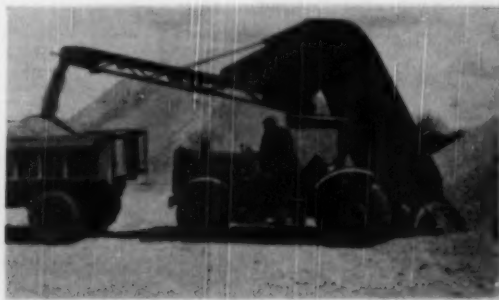
Extensive use of cost-reducing belt conveyors is evident in this view of Uvalde Rock Asphalt Company's plant.

MINES 6 MILES OF ROAD PER DAY

Every day from 3,000 to 4,000 tons of processed rock asphalt are produced by the Uvalde Rock Asphalt Company out in Blewett, Texas—enough to put a 1-inch top course on 6 to 7 miles of road. This impressive production achievement is made possible largely through the use of belt conveyors that handle all the material through processing operations to the various stock piles. B-G Belt Conveyors are ideally suited to this type of operation, where relocation is frequently necessary. They are easily disassembled, relocated and reassembled as conditions dictate.

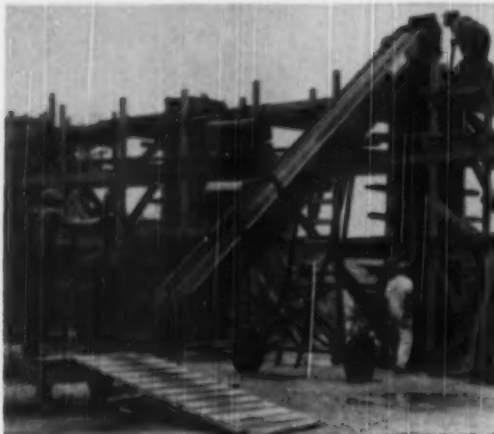


HISTORICAL SITE FOR TURNPIKE PLANT. A modern B-G belt conveyor system identifies Pennsylvania Aggregate's Cornwall plant which is located on famed Cornwall Banks—site of one of the world's greatest mines—oldest continuously operated in the new world. The two-century accumulation of limestone—eight million cubic yards—is being processed for use by various Turnpike contractors.



NEW LOADER HAS LONG REACH. Longest, highest trucks, trailers—even railroad cars—are loaded to full capacity at a 3 yd./min. clip by the B-G 543 loader. Hydraulically controlled conveyor swivels to trim load, eliminates spillage or partly filled trucks. The 543 travels at 1.5 m.p.h. on its tractor-type chassis is easily convertible to a 7-11 yd./min. snow loader to give year 'round service.

Barber-Greene Photo-News



WET CONCRETE GETS A LIFT. Another example of the broad variety of work that can be done by B-G portable conveyors came up on a recent H. A. Dailey Company job near St. Louis. A number of 16-foot columns were poured by Dailey's B-G portable—eliminating costly ramps and scaffolding, allowing simple buggy loading. The job was done quickly at lowest cost by this portable Barber-Greene which, incidentally, was towed all the way from Aurora, Illinois, to the job, over 250 miles. Portability like this pays off on job after job.

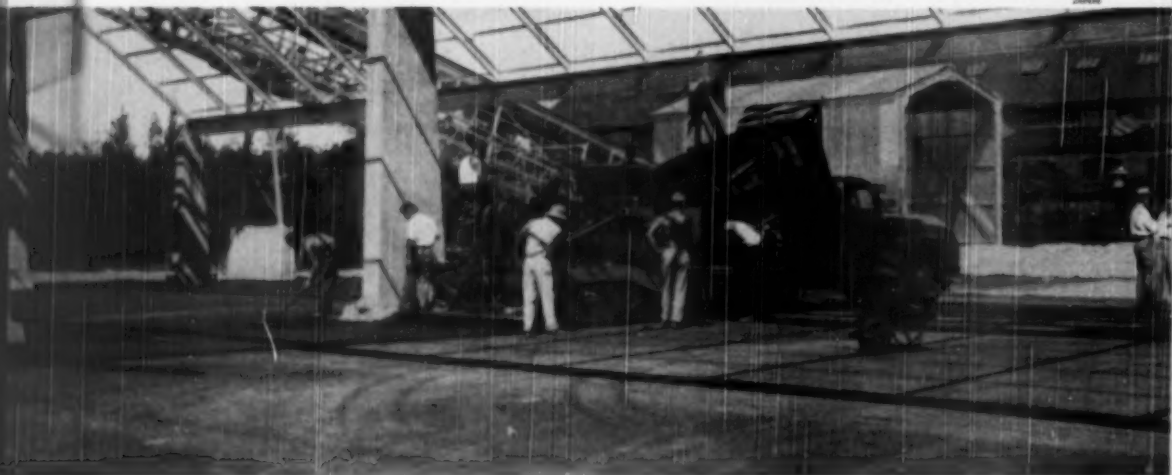


"AT HOME" IN MIAMI SUBDIVISION. Digging footings by hand in tough coral rock is an expensive operation that's avoided by such Florida contractors as the Clinton Construction Company in Miami. On a large subdivision project recently, all footings were dug by their B-G ditcher on an "efficient and economical" basis. Coral rock, caliche, frozen ground—even bituminous pavement—pose no problem for B-G Vertical Boom ditchers. Their "milling action" enables them to cut through toughest material, leaving a clean-bottomed, smooth wall trench.

INSIDE JOB

By a Smooth Operator

When the state of New Hampshire decided to improve the footing and reduce adulteration by surfacing the floor in its Concord cooling base shed, a B-G finisher owned by The Manchester Sand and Gravel Company took over the job. In the shed area, which was restricted by several rows of I-beam roof supports, it maneuvered smoothly to place 500 tons of material with a minimum of hand work required for finishing. The base and binder course were laid the length of the building, and the final sheet asphalt course was laid at right angles to them. Result: a smooth, weatherproof surface at lowest cost.



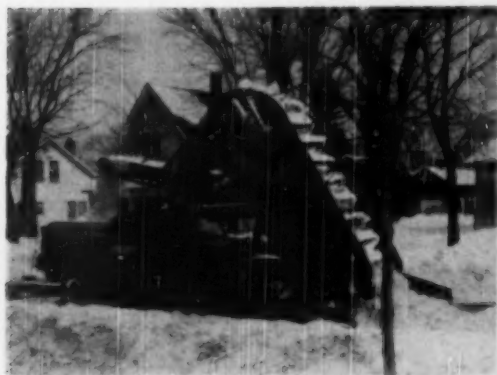
for full, fast information on any equipment

A NINE-YEAR-OLD MAKES GOOD IN NEW CAREER

Back in 1941 a B-G Travel Plant mixer started its working life with Rein and Schultze, Wisconsin road builders. Today, nine years and many hundreds of miles later, this original Travel Plant forms the nucleus around which the owners have built a highly efficient single aggregate plant. With a B-G Dust Collector and low pressure burner Dryer, this setup produced 120 tons of mix per hour in recent work on Wisconsin Highway 71. Future plans involve the possibility of adding a gradation unit for producing multiple aggregate hot mix. Barber-Greene long-term sturdiness combines with Barber-Greene flexibility to greatly extend and prolong the usefulness of B-G asphalt mixing equipment.

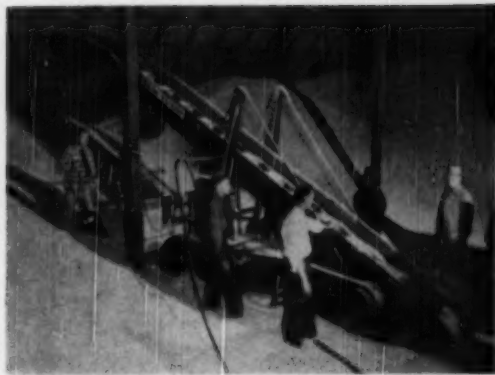


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REMINDE YOU OF LAST WINTER? Communities where snow took its toll last winter—in lost parking meter revenue, traffic and business interruptions and the like—should plan now to be ready next year to minimize these losses and to cut the cost of clearing snow quickly. The new Barber-Greene Model 544 is within the budget of small communities. It travels at 15 miles per hour—and loads up to 11 cubic yards a minute, keeps trucks on the move with a minimum of manpower. An added asset: it can be converted to an all-material, 3 yard-per-minute truck loader for summer use at little cost other than for exchanging the bucket lines. Other B-G Snow Loaders with capacities to 20 cu. yd./min.



GLOBE-GAZETTE PHOTO

NEW TWIST FOR A "GOOSENECK." The versatility of a B-G Gooseneck Loader eliminated the need for extra investment in machinery for the Farmers Elevator Co. of Mason City, Ia. Far with the problem of cutting costs in loading, unloading and reclaiming coal, they needed mechanical help in storing over 55,000 bushels of corn. Their B-G "Gooseneck," along with its coal business duties, handled this job—loading storage bins at a rate of 300 bushels in 20 minutes. The exclusive "Gooseneck" design of this Barber-Greene—which minimizes degradation when handling coal—was an asset in handling seed corn as it helped prevent damage to the kernels.

on these pages--see your B-G Distributor

IT'S A BRIDGE— FOR AGGREGATE ONLY

When your sand deposit is on one side of a navigable stream and your plant and railroad facilities are on the other, you have a problem similar to that one faced by Becker County Sand and Gravel Company in Fayetteville, North Carolina. Their solution: a unique bridge with 55-foot clearance carrying a 408-foot B-G belt conveyor, and another B-G conveyor that takes the sand and gravel to the washing and screening plant. Currently, this company is moving around 25 cars per day from this plant—another "special" problem solved through the use of standard, pre-engineered, easy-to-install Barber-Greene belt conveyors.



240403

TRIPLE PLAY BY WELL-KNOWN TEAM. From siding to tiles via B-G hopper-car unloader and B-G transfer and shuttle belt conveyors is a fast, low-cost trip for materials used by Imperial Redi-Mix Company in their plant at Melrose Park, Illinois. Mechanized "push button" handling with this unloading-storing team reduces the manpower requirements to a minimum.

SERVICES THAT PAY—MORE THAN THEY COST

There is much for you to gain in calling upon your Barber-Greene distributor for help in solving problems involving the handling of all materials . . . mixing and placing bituminous surfacing materials . . . as well as ditching and snow removal. Your B-G distributor and his sales and service representatives have been through intensive training courses at the Barber-Greene factory. They know how to apply Barber-Greene equipment to assure the most in performance on your job—they know how to show you the best in maintenance practice. Further, your B-G distributor has service and repair part facilities you can depend upon through the years. For complete information—bulletins, specifications and prices on any or all Barber-Greene equipment—get in touch with your B-G distributor or call, write or wire directly to the address below.



Barber-Greene Company
AURORA, ILLINOIS, U. S. A.

EATON

2-Speed Truck

AXLES pay for Themselves Over and Over



Eaton 2-Speed Axles give your trucks added utility, improved performance, faster operating speed, more pulling power. They effect important savings in operating and maintenance costs. Eaton 2-Speed Axles provide the right gear ratio for road and load conditions. They permit engines to run in the most efficient and economical speed range, reduce stress and wear on vital vehicle parts and actually make trucks last longer. Eaton 2-Speed Truck Axles are available for most trucks of the 1½-ton class and larger. Ask your truck dealer how they will more than pay for themselves in your operation.



Axle Division

EATON MANUFACTURING COMPANY
CLEVELAND, OHIO



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U. S. Public Roads Adm.*

A word or phrase in one branch of engineering may have an entirely different meaning

in some other branch. This book is offered as a step toward avoiding misunderstanding between the different branches of engineering, the public and other professions. It is arranged in dictionary form. Appendices include foreign language terms; symbols; abbreviations; weights and measures; conversion factors. 439 pages—\$4.00 plus postage.

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TRANSPORTATION



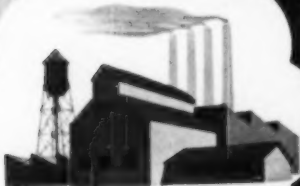
LOGGING



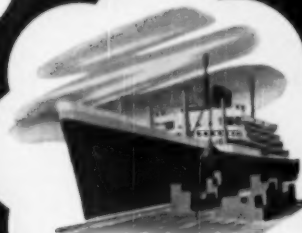
MINING



PETROLEUM



MANUFACTURING



MARINE



CONSTRUCTION



LINK-BELT SPEEDER



as a reporter . . .

I'm going to travel and tell you about Link-Belt Speeder machines, jobs and owners in all parts of this great country.

I like to write about Link-Belt Speeder Shovel-Cranes because I know the complete line is engineered and built to contractors' specifications.

I have already learned that owners appreciate Link-Belt Speeder ruggedness; they know how well they stand up under high pressure road building conditions, digging earth and rock everywhere. And they tell me Link-Belt Speeder distributors are always ready and willing to help with service and maintenance problems **RIGHT NOW**.

Operators say: "Speed-o-Matic hydraulic controls are wonderful: We can get the speed and steady production that makes the Boss smile — for a change."

This job of reporting on Link-Belt Speeder operations promises to be a cinch. I just tell them where I'm from and owners and operators tell me plenty of good things about their Link-Belt Speeders. And when they're happy and proud to boost their machines, Brother, it's always a pleasure to write this good news to the folks back home.



"They" say the New LS-51 is a Honey!

The true word is spreading fast that the new LS-51 is the fastest, easiest operating, most dependable machine in the $\frac{1}{2}$ yard field.

The LS-51 above, equipped with $\frac{1}{2}$ yard bucket is the fifth Link-Belt Speeder owned and operated by Lloyd Vandegrift of Minerva, Ohio. He's been operating shovels for 26 years and he says: "Sure I like my new LS-51, especially the easy operation of Speed-o-Matic controls. I keep the trucks humming all day, and you know what that means."

LINK-BELT SPEEDER



LINK-BELT SPEEDER CORPORATION
CEDAR RAPIDS, IOWA

*"Builders of the Most Complete Line of
SHOVELS-CRANES-DRAWLINES"*

**YOU CAN'T
DO THIS**
with any other
single unit!

PLAN your job for the MultiFoote with the HighLift Boom. Built in three capacities from single to double drum it brings you high output, gives you better control of your concrete delivery and will place concrete 23 ft. up with a standard boom (greater heights with longer booms).

Crawler traction permits easy travel over the ordinary rough ground conditions of a construction job and will not dig itself in as do wheels. Bucket controls are at the bucket where they should be to handle exact placement to hoppers or spouts. MultiFoote Simplicity makes maintenance easy and keeps costs low. Check this column at the right and see what you eliminate for cost cutting and note what the MultiFoote and the HighLift Boom make possible. More information on how it will help you if you will ask us.

THE FOOTE COMPANY, INC.

Subsidiary of Blaw-Knox Co.
1936 State Street Munda, New York

MULTIFOOTE PAVER
FOR EVERY PLACE CONCRETE MUST BE POURED

What the Direct Pour will do!

- Places concrete 23 ft. up with a standard 35 ft. boom. Greater heights with longer booms.
- Loads open truck bodies.
- Feeds Pumpcrete.
- Feeds hoppers or concrete buggies.
- Will travel along and pour direct to forms.
- Travel and-pour series of basement foundations and / or wall.
- Travel between forms and pour footings.
- Pour walls in low headroom where crane can't work.
- Pour floor or highway.

What the Direct Pour Saves!

- Eliminates crane and concrete bucket.
- Eliminates mixer.
- Eliminates chuting tower or other elevating equipment.
- Reduces ramps and false work required.
- Reduces ground crew.
- Reduces concrete haul for buggy men.
- Reduces time always lost in transferring concrete from one piece of equipment to another.



DO YOU LAY BLACKTOP?

The Adnun does a better job particularly with cold mixes. Its sturdy structure eliminates rebuilding periodically and its flexibility permits laying any type of aggregate. Ask for complete details.

ADNUN BLACK TOP PAVER



gives you the winning combination
Mobility *plus* Performance *plus* Stamina



LIMA Truck-Mounted "Paymaster" that pays extra dividends because it can travel between jobs *on its own power*—at automotive speeds. Type 34-T is a convertible shovel, crane, dragline or pull shovel, mounted on a standard 10-wheel truck crane carrier with independent engine for travel. It has a crane capacity of 20 tons (35 ft boom, 10 ft. radius) and shovel capacity of $\frac{3}{4}$ or 1 yd., with outriggers extended. It can travel up to 31 M. P. H. Rotating equipment duplicates that of the famous crawler mounted "Paymaster", with alterations adapting it to truck mounting—thus assuring the same high peak, continuous performance which has made the "Paymaster" the leader in its field.

"Wheel-Mounted" units also available

You can now also get the LIMA "Paymaster" and the LIMA Type 604 (35 ton crane) in a single engine wheel mounted unit. Crawler Mounted LIMA machines are available in Shovel capacities from $\frac{3}{4}$ to 6 yards, Cranes to 110 tons and Draglines variable.

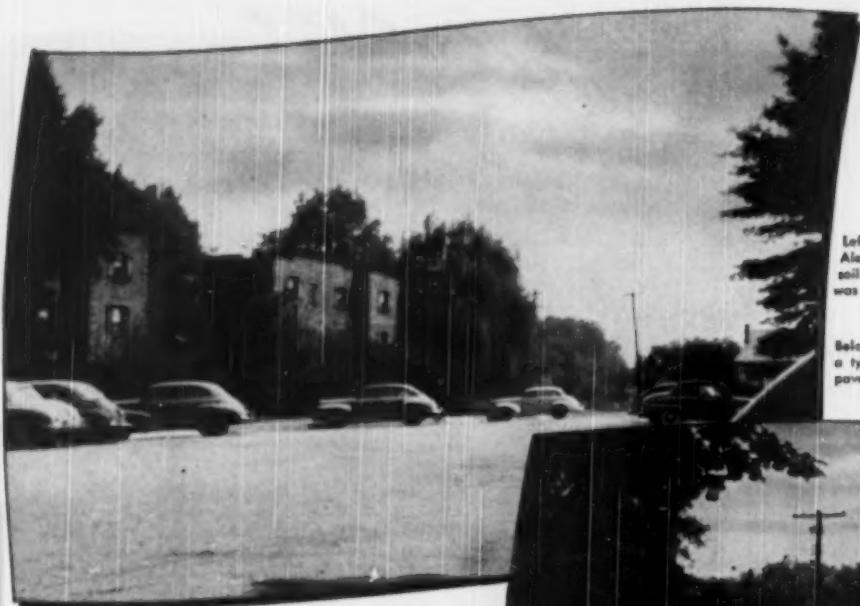
It will pay you to consult your nearest LIMA Sales Office or Representative before you buy your next shovel, crane or dragline. Offices in principal cities of the world.

Lima Shovel and Crane Division

LIMA, OHIO

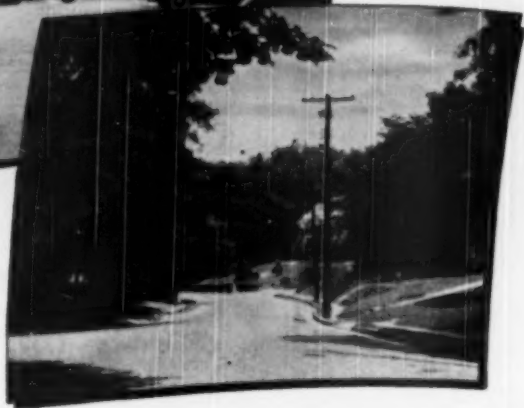
OTHER DIVISIONS: Lima Locomotive Works Division; Niles Yawl Works Co.; Hiram, Ohio; Hantschler Co.





Left: Bruce Street, Alexandria's first soil-cement street, was paved in 1939.

Below: Woodland Terrace, a typical residential street, paved with soil-cement, 1941.



SOIL - CEMENT paves the way to durable, economical streets in Alexandria, Va.

IN 1939, Alexandria, Va., experimented with soil-cement paving in a one-block-long project on Bruce Street. This pavement withstood the severe winter of 1939-40 without a single surface break while virtually every other secondary street in the city suffered heavily from the extreme weather.

That demonstration, plus soil-cement's low first cost, convinced city officials of soil-cement's practicability for light-traffic streets. Since then more than 200,000 sq.yd. of soil-cement pavement have been placed in Alexandria. The superior performance of that paving prompted the City Council in 1948 to pass an ordinance specifying soil-cement base with bituminous surface for light-traffic streets in residential zones and concrete for heavier-duty streets.

C. L. Watkins, Alexandria City Engineer, writes: "The first winter's experience on Bruce Street has been followed by more than 10 years of added serv-

ice. Our records show that there has been practically no maintenance on the soil-cement base.

"Our choice of soil-cement is predicated on two important factors—economy and durability, plus the fact that our soil conditions are favorable. The initial cost and low-maintenance cost of all-weather soil-cement base make it economical. Its durability is proved by its record to date of carrying daily traffic for over 10 years. In my opinion, the use of soil-cement is a major and permanent asset to our city."


Here's why soil-cement roads and streets are economical: (1) about 90 per cent of the required material is usually native soil already on the site, (2) construction is fast—large daily production, (3) inexperienced crews can quickly learn the simple construction procedures. For more information about economical, durable soil-cement roads and streets, write for free booklet available in U. S. and Canada.


PORTLAND CEMENT ASSOCIATION

DEPT. 5-28, 33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

Which Produces More?

... one  4'x 10' screen

... two  4'x 10' screens

Naturally, two screens produce twice as much as one if the same size material is fed to both

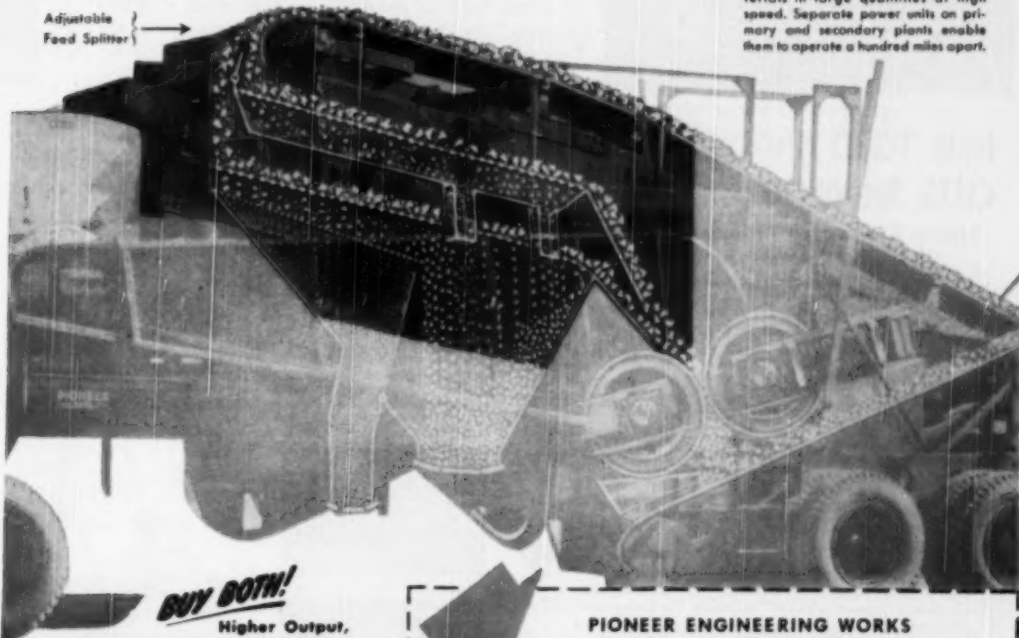
Pioneer uses the two screen principle in its 2-Unit Rock and Gravel Plants. Split Deck Feed (see illustration below) doubles the screening capacity of the secondary plants.

Here's how it works. An adjustable baffle plate located at the feed end of the screen splits the flow of material from the conveyor. Part goes to the top screen and part to the bottom. Top and bottom decks have the same screen mesh. Each produces specification independent of the other because they are separated by a blank center deck. Material from the top screen is *chuted around* the bottom deck to the pay hopper.

This unique method of feeding the screen on the secondary plant gives you more material because the screening area is doubled ... gives you better sized material because your screens aren't overloaded.

A new catalog shows how Split Deck Feed doubles the screening capacity of Pioneer 2-Unit Plants. Photographs and engineering drawings furnish complete details on the six primaries... three secondaries. Mail the coupon today for your copy.

Adjustable
Feed Splitter



BUY BOTH!

Higher Output,
Lower Upkeep!

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● Please mail your new 20 page Catalog on Pioneer Two-Unit Plants with Split Deck Feed.

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SIX PRIMARY PLANTS. Made for either rock or gravel, will fit your needs. Lever on overhead eccentric jaw crusher balances the load between primary and secondary crushers while plant is running.



THREE SECONDARY PLANTS, with Split Deck Feed, produce small materials in large quantities at high speed. Separate power units enable them to operate a hundred miles apart.

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Welded Buckets

Operators prefer the Wellman Bucket for its balance, easy handling, and digging power. Owners prefer the Wellman Bucket for its bigger payloads, lower maintenance cost. These features are not accidental. Wellman pioneered in welded construction of rolled steels which make these buckets lighter, stronger, for greater yardage at lower costs. In all types and sizes, you'll do better with a Wellman!



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Wellman Bucket
for every service

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7003 CENTRAL AVENUE CLEVELAND 4, OHIO

NEW TORO HIGHWAY MOWER CUTS MOWING TIME IN HALF

Sickle driven by independent engine
gives constant cutting speed
regardless of tractor's
traveling speed



The new Toro "Roadmaster" cuts weeds, brush and saplings which are impossible to cut with conventional "power take-off" mowers. Its independently powered sickle maintains a constant cutting speed... shears through growth up to 2 1/2" ... does a much cleaner job in half the time!

This low-along tractor sticks on slopes steeper than 35°... mows over curbs from 1 1/2" to 10" high... travels up to 48 m.p.h. between jobs. Fast acting hydraulic lift controls sickle at angles from 45° down to 90° up.

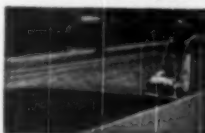
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Works flush to walls, curbs, tracks, manholes.

Striking 1900 blows per minute, each of more than 1250 ft. lbs. impact, the Wayer Impactor produces density greater than a 10-ton roller and in places a roller can't reach. Heated plate cures surface, ready for immediate traffic. Transports on material truck. One man operates. Big cost-savings.



Can work flush to curb edge

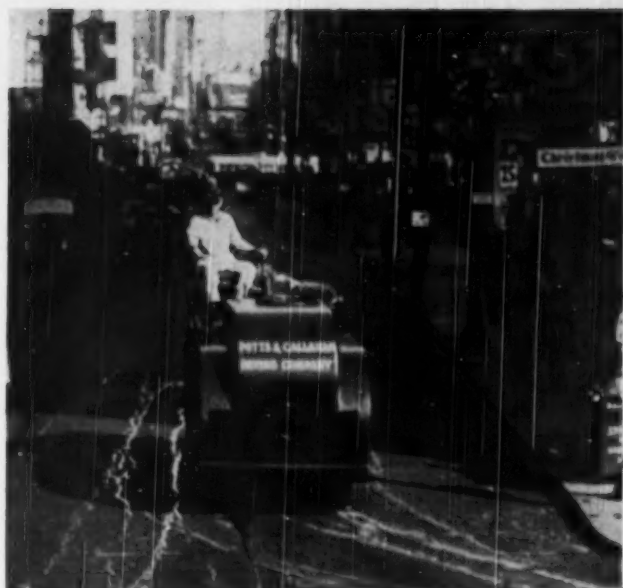


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and name of
distributor.



WAYER IMPACTOR

Wayer Impactor, Incorporated, 12 N. Third St., Columbus 15, Ohio



HOW TO PAVE A MILE A DAY!

Last summer the City of Baltimore, Maryland found it necessary to repave 14 blocks of busy Baltimore Street and awarded the contract to P. Flanigan & Sons Co., Inc. When the city fathers expressed concern over interruption to traffic while work was in progress on this vital city artery, there occurred an outstanding example of what can happen when civic minded contractors get together. The Flanigans conferred with six of Baltimore's leading contractors with the result that, on a single work-packed Sunday, all seven contractors combined to pave fourteen city blocks. Over a mile in length, the work took place between Fremont Avenue and Calvert Street. Twenty-five thousand square yards of asphaltic binder and topping were put down in sixteen hours of continuous operation. With the exception of the motor trucks needed to haul surfacing materials, more rollers were required than any other

type of equipment on the job. Of the eighteen tandems employed, twelve were Buffalo-Springfields. This heavy Buffalo-Springfield preference is best expressed in the words of Mr. Pierce Flanigan:

"On a job like this, dependability is what counts and that's why we've used Buffalo-Springfield Rollers exclusively for the past forty-odd years. Our operators like them and we appreciate their low operating and maintenance costs."

Preference based on actual field experience is predominantly a Buffalo-Springfield success story—and one worth remembering when determining your roller needs for the work ahead. Your nearest distributor will be happy to tell you about the many exclusive features of the Buffalo-Springfield Heavy Duty Tandems—features that will help you in trimming costs and increasing production on all your jobs. Why not see him today?

PLAN OF WORK

National Paving & Contracting,
Fremont to Pine Street
Baltimore Asphalt Block & Tile,
Pine to Pearl Street
Mahoney Brothers,
Pearl to Park Street
Potts & Callahan,
Park to Howard Street
American Paving & Contracting,
Howard to Sharp Street
P. Flanigan, Sharp to Charles Street
Arundel Construction, Charles to Calvert Street

BILL OF EQUIPMENT

7 asphalt mixing plants
10 asphalt finishers
18 rollers (8 to 12 tons)
9 air compressors
7 asphalt spray machines
105 motor trucks

12 of 18 rollers used on retard
breaking project in Baltimore were
Buffalo-Springfields.



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☐ Please send me Catalogue S-55-49 describing the right model for my requirements. ☐ Notify Distributor to call.

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CITY _____ STATE _____



Ten Years Ago...

In August, 1939, this concrete test paving was laid in Second Avenue North, Minneapolis. The badly scaled section of roadway in the background was made with regular portland cement. The foreground section, laid at the same time, was made with Atlas Duraplastic—the first commercial use of the air-entraining portland cement originated and developed by Universal Atlas.

Both sections, subjected to the severity of ten Minneapolis winters and to heavy applications of de-icing salts, are shown just as they appeared in July, 1949—convincing proof of the characteristic durability of Duraplastic concrete, of its high resistance to freezing-thawing weather and the scaling action of de-icing salts. Longitudinal structural crack shows some ravelling. Note perfect transverse joint.



Today . . . It's DURAPLASTIC* for more durable concrete



South Cancho River Bridge—U. S. Route 87 and U. S. 277, Tom Green County, Texas. Atlas Duraplastic used for bridge structure and paving. Contractor: M. E. Warrell, Austin, Texas.

Throughout the past decade, concrete made with Atlas Duraplastic Air-Entraining Portland Cement has proved to engineers and contractors its greater durability in paving jobs—and its improved surface appearance in structural uses. Its advantages have been applied to all types of mass and structural concrete—for foundations, walls, columns, and floors. It's ideal for slip-form, gunite, stucco and similar uses.

With Duraplastic, less mixing

water is needed for a given slump. The resulting mix is more plastic, more uniform and more cohesive. It's easy to place and finish. Bleeding or water-gain and segregation are reduced. Paving concrete has higher resistance to the effects of freezing and thawing and the scaling action of de-icing salts; structural concrete exhibits improved surface appearance.

Duraplastic provides the precise amount of air-entraining agent inter-

ground with the cement for satisfactory field performance. It complies with ASTM and Federal Specifications, sells at the same price as regular cement and calls for no unusual changes in procedure. For further information write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

OFFICES: Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.

*"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.

RD-11-501

ATLAS DURAPLASTIC

AIR-ENTRAINING PORTLAND CEMENT

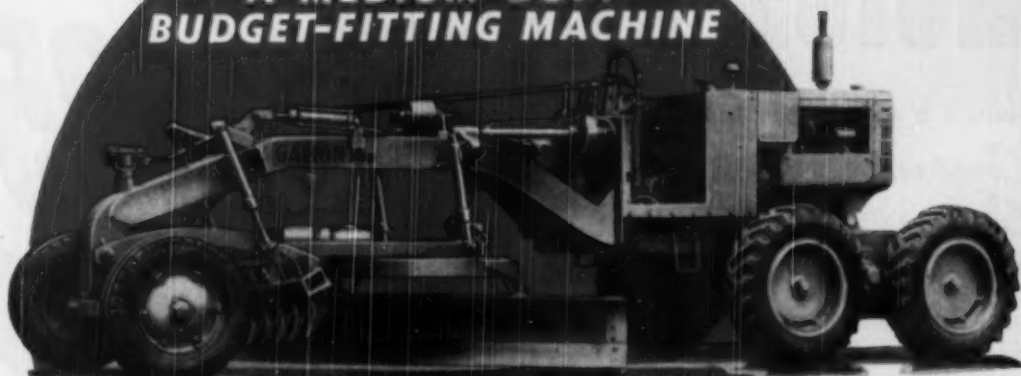
MAKES BETTER CONCRETE AT NO EXTRA COST



"THE THEATRE GUILD ON THE AIR"—Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network

GALION *Model* **303** **MOTOR GRADER**

**A MEDIUM-DUTY
BUDGET-FITTING MACHINE**



*Is
money or performance
more important
to you?*

If the purse is the controlling factor in your motor grader needs, the Galion 303 can be supplied with less costly single drive, manual steering, and 7.00-20 front tires.

But if you want highest possible performance out of an economical 45 h.p. grader, the Galion 303 can be supplied with 4 wheel tandem drive, hydraulic booster steering, and 10.00-24 front tires. Write for literature.

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TANDEM DRIVE MOTOR GRADER

Here's a value that invites comparison

Compare **THE PRICE!**

Compare **THE FEATURES!**

Compare **THE PERFORMANCE!**

... and you will agree

**THE ALLIS-CHALMERS MODEL D IS
YOUR BEST BUY...BY A LONG WAY**

only
\$3,585

F.O.B. Springfield, Ill. Taxes,
attachments and export pre-
paration extra. Price subject
to change without
notice.

Not a converted job... it's **ENGINEERED NEW
FROM THE GROUND UP** — to bring you BIG
grader design and performance advantages:

- ✓ Tandem Drive
- ✓ Tubular Frame
- ✓ Roll-Away Moldboard
- ✓ Power Hydraulic Controls
- ✓ Complete Operator Comfort
- ✓ Rear-Engine Design
- ✓ High Arch-Type Front Axle
- ✓ Drop Down Transmission
- ✓ Full Visibility
- ✓ Simplified Servicing

... Plus special attachments that widen its usefulness — Rear-End Loader, Scarifier, Windrow Eliminator, "V" or Blade-Type Snowplows. Also, various other accessories. Electric starter and lights standard equipment.

"Seeing is Believing." Ask Your Allis-Chalmers Dealer for a Demonstration.



ALLIS-CHALMERS

MODEL D

WEIGHT — 8,500 lb. (bare)

BRAKE HP. — 34.7 (famous Allis-Chalmers gasoline engine)

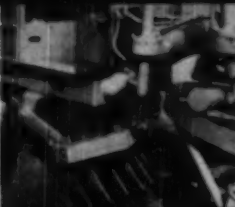
SPEEDS — four forward, 2.40 to 18.61 mph.; reverse to 2.9



REAR BLADES OFF FROM OPERATOR'S PLATFORM — Hydraulic blade lifts — low, positive, trouble-free, only one, standard function.



ALL-VIEW CAB — safety shield off as required.



HYDRAULICALLY CONTROLLED SCARIFIER — Limited load or zero or reverse down pressure. Fast, accurate tilting, controlled penetration. Easy, positive clearing resulting from greater forward stability.



FOR SOME JOBS on all projects
FOR ALL JOBS on some projects

- Maintains dirt and gravel roads and streets.
- Cuts sod from shoulders. Handles light construction.
- Builds and cleans ditches. Slopes banks — up to 2:1.
- Levels sub-grades. Ideal for maintaining haul roads and finishing work.
- Plows snow. Loads all types of materials. Scarifies.
- Does outstanding work on every job — the year around, at big savings.



LOADS MATERIAL into trucks, vans, and trailers. Loader — from wheelbarrow to excavator... simple lift or dump. Instantly retracted, ready to move. 10' bucket — available with back teeth. Note carrying position of bucket in front-end view. Scarifier in back.



HYDRAULICALLY CONTROLLED SCARIFIER — 10' or 12' bucket. Hydraulic control, controlled penetration. Blade may also be used for backfilling and backhoe work.



HYDRAULICALLY CONTROLLED SCARIFIER — 10' or 12' bucket. Hydraulic control, controlled penetration. Blade may also be used for backfilling and backhoe work.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

For Greater Production...For Easier Operation...For Simplified Servicing

The New INTERNATIONAL TD-24



HERE'S WHAT THE



Positive all-weather starting on gasoline, with quick change-over to full diesel operation, all from the seat.



Separate reverse lever for quick change of direction. The tractor moves in the direction the lever is moved.



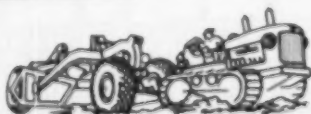
Self load and run with scrapers of 17-yard capacity—and shift gears on-the-go with the rolling load.



Cut waste shifting time out of work cycles, provide the best speed for every operation, 8 speeds in each direction!



INTERNATIONAL



CHAMPION of Crawlers

"The TD-24's work right along on slopes so steep we have to cut them down before other tractors can climb them even without loads," says Bob Rardin of Rardin Brothers, Akron, Ohio. "They are fast tractors, easy to shift and have plenty of power. This combination really moves dirt." His TD-24 was equipped with a bulldozer.

"It will out-buck any tractor I've ever run," says Harold Wooley's operator, Drain, Oregon, "and sure push dirt up hill—and climb steep grades." His TD-24 works regularly on 30% to 50% grades, building mountain roads.

"I wouldn't have anything else," says another Oregon operator. He works for V. R. Russell &

Sons of Valsetz. "It's sure fine on bulldozing; best dirt mover I ever got hold of."

That's the way owners and operators talk about the International TD-24 Crawler. It has earned their praise, for it does everything any other big tractor can do, *plus many things that NO other tractor can do.* The TD-24's versatility makes it the most useful and profitable earth-mover in any equipment line-up.

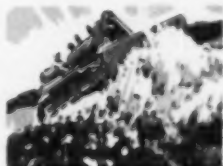
Visit your International Industrial Power Distributor for a demonstration. Then ask yourself how long you can get along without this big red worker and the extra earnings it will produce.

INTERNATIONAL HARVESTER COMPANY
Chicago

TD-24 CAN DO FOR YOU



Instant speed change up or down one speed, or stop, without declutching. Planet Power drive does it!



Work on grades up to 100%. Its power, ground contact, balance and lubrication are right for licking any grade.



Planet Power steering puts turn with power on both tracks, feathered turn and pivot turn at your fingertips.



Handle heaviest loads on gradual turns as easily as straightaway because both tracks are powered in the turn!

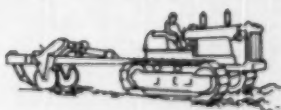


Torque Control feature of fuel injection pump increases engine torque when needed to overcome overloads.



Push or pull through tough going. The engine delivers extra "power" when its r.p.m. is pulled down by load.

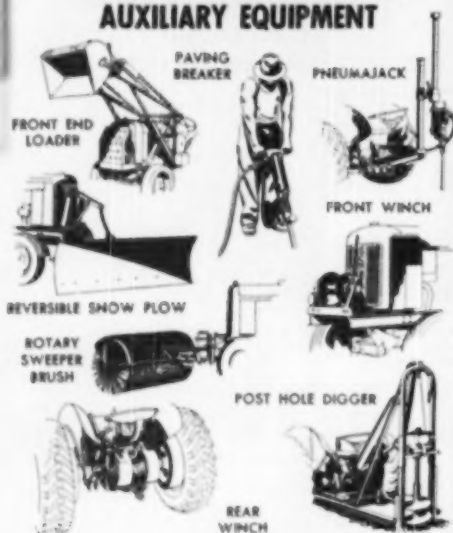
INDUSTRIAL POWER





The Pneumatractor

SCHRAMM PNEUMATRACTOR AUXILIARY EQUIPMENT



... Presenting the Latest—Most Modern

SELF-PROPELLED AIR COMPRESSOR

SCHRAMM'S newest unit, the *Pneumatractor*, an air compressor that is also a tractor.

Extremely versatile, it is NOT a power takeoff or power unit mounted on a tractor, but is powered with Standard Model 60' *Unistage* or the 105' *Pneumapower* Schramm Compressor. Available with a completely engineered and approved set of accessories, a few of which are illustrated at the left.

FOR FULL DETAILS, WRITE TODAY FOR BULLETIN NEU-50.

SCHRAMM INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

BLAW-KNOX EQUIPMENT

earns More Profit



There's a Blaw-Knox Portable Batching Plant in a size and type for every job, from paving highways to building big dams—2, 3 or 4 compartment Aggregate Batchers with 100 to 120 ton capacities—500 and 400 bbl. Bulk Cement Plants with combination arrangements to double these capacities.

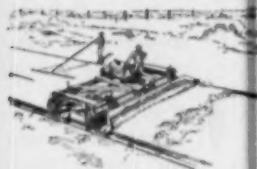
STEADY consistent production at lowest possible cost—that's Blaw-Knox performance that earns you profit on every construction job. Whatever your job—building big dams or bridges, small sewers or culverts, paving super-highways or Main Street—it will pay you to put your operations on a cost-cutting assembly-line basis with the Blaw-Knox "Complete Package" of construction equipment. It contains everything you need to solve your concrete problems, from material handling to finished slab, and includes Paving Forms, Subgraders, Central Mixing Plants and the Hi-Boy Trukmixer in addition to the equipment shown here. Write for complete details or see your nearest Blaw-Knox distributor.



CLAMSHELL BUCKETS in a wide range of types and sizes for rehandling, trenching, dredging or hard digging.



CONCRETE BUCKETS speed work, cut concrete pouring costs. Built to handle huge quantities of low slump concrete.



FINISHING MACHINES assure highest quality of finish of concrete pavement regardless of the type of concrete mix specified or required.



CONCRETE PAVING SPREADERS automatically spread and dry mix of two 34-8 dual drum pavers no matter where the concrete is placed on the subgrade.



STEEL CURB AND GUTTER FORMS, a complete form system for every curb, curb and gutter, integral curb, special curb and sidewalk job.

BLAW-KNOX

BLAW-KNOX DIVISION OF BLAW-KNOX CO., Farmers Bank Bldg., Pittsburgh 22, Pa.
New York • Chicago • Philadelphia • Birmingham • Washington



COMPARE

before you buy

COMPARE

the **BONUS PRODUCTION** offered by
UNIVERSAL'S EXCLUSIVE **TWINDUAL METHOD**



TWINDUAL ROLL CRUSHER
Two sets of double rolls in a single machine

Get all these advantages with the
TWINDUAL Method in Rock and Gravel Plants

Three Full Stages of Reduction . . .

First stage—Jaw Crusher

Second and Third stages—TwinDual Rolls

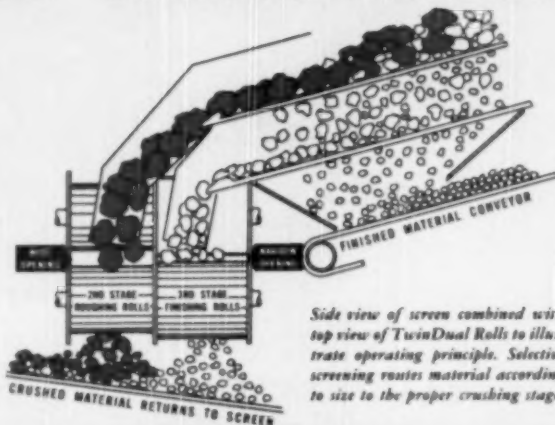
TwinDual Rolls are in effect two roll crushers, yet save weight and space required by two separate units.

Wide feed opening of Second Stage (see illustration) permits up to 100% wider jaw crusher discharge opening. This provides better angle of nip, doubles jaw capacity, greatly reduces jaw wear and results in faster discharge of material from jaw crusher—no clogging.

30% to 50% of material entering Second Stage is reduced to finished size and does not require reduction by the Third Stage.

Finished material removed before and after each of the three crushing stages increases production. Selective screening routes oversize to the proper crusher.

No material enters any crusher unless crushing by that stage is required. Capacity is increased because crushers are not burdened with unnecessary material—roll shells and jaws last longer.



Side view of screen combined with top view of TwinDual Rolls to illustrate operating principle. Selective screening routes material according to size to the proper crushing stage.

PORTABLE AND STATIONARY
Types of rolls, screens, crushers, for rock and gravel

Tried and proved by more than 10 years of successful operation in the field. TwinDual owners report high production with low operating and maintenance costs. Feature for feature, capacity for capacity, weight for weight, compare Universal TwinDual Plants with the field. Get all the facts now.

Write for complete information

Universal builds a variety of "Right Combinations" of crushing, screening, washing and conveying equipment for rock, gravel and slag.

UNIVERSAL ENGINEERING CORP., Division of PETTIBONE MULLIKEN CORP.

631 C Avenue N. W., Cedar Rapids, Iowa
Phone 7105

4700 W. Division St., Chicago 51, Ill.
Phone SP aulding 2-9300



88-H...99-H...MASTER 99



Every Pound of Weight is on a Wheel that
DRIVES and STEERS

That's why these husky graders, with their full hydraulic control, just naturally...

Go Places where ordinary graders cannot go.

Do Things ordinary graders cannot do.

Outperform ordinary graders on every job.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U.S.A.



When writing advertisers please mention **ROADS AND STREETS**, May, 1950

RUEMELIN *Portable* SAND BLAST GENERATORS



FOR CLEANING BRIDGES — WATER TOWERS — STRUCTURAL STEEL

Many contractors use Ruemelin Blast Generators for cleaning steel work to remove rust, paint and scale before repainting. These machines are also used to remove laitance from cement wherever concrete construction is in progress. A wet adapting nozzle can be furnished to convert dry machines to wet type of operation.

Ruemelin Generators are built in several sizes, 400 lb. to 10,000 lb. capacity. Single or two hose outlets. We can care for your complete requirements, including blast hose, tungsten nozzles, operators' helmets.

Agents in principal cities. Prompt shipment on most sizes. Write for Bulletin 36-B.

RUEMELIN MANUFACTURING CO.

3990 N. PALMER ST. • MILWAUKEE 12, WIS., U.S.A.

Manufacturers and Engineers SAND BLAST AND DUST COLLECTING EQUIPMENT. WELDING FUME COLLECTORS

GREAT SLEEPS IN HISTORY



...was the little girl who slept and dreamed of Wonderland. *Slumberland* is the favorite dream of over a quarter of a million guests who annually rest on these wonderful, cloud-comfortable beds at

CLEVELAND'S HOTEL HOLLENDEN

ROBERT P. JOYCE, GENERAL MANAGER

For Modern Low-cost JOINT MAINTENANCE



You'll save time, cut costs . . . with a

TENNANT MODEL G JOINT-CLEANING MACHINE

Helps assure pavement joints of well-sealed, year-round protection. Operated by one man, machine routs out old seal and dirt . . . up to 20,000 lineal feet per day. Cutters clean and roughen side walls for snug, durable bond with modern seals. Easy to use.

Write today!

—for copy histories and illustrated bulletins.

Features

ENGINE: 13½ HP Wisconsin 2 cyl, 4 cy. Air-cooled.

CUTTER HEAD: 12" diam. case-hardened steel. Revolves at 2400 rpm. 2 sizes. Has 4" cutters, adjustable for joints ½" to 4" wide.

OTHER USES: Cleans irregular cracks; removes extruded material, leveling bumps; scores concrete, brick, etc.

G. H. TENNANT CO.
2578 North Second St.
Minneapolis 11, Minn.

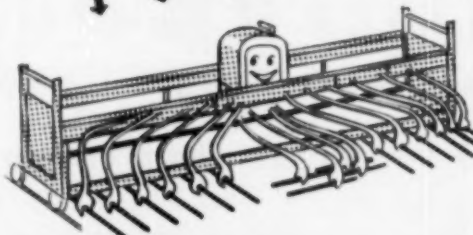


Joint-Cleaning Machines

OFFICES IN PRINCIPAL CITIES

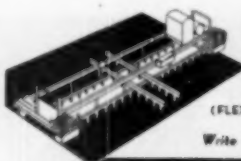
IMPORT OF EQUIPMENT FOR MAINTENANCE OF FLOORS, DECKS, ROOFS, HIGHWAYS

that FLEX-PLANE
BAR INSTALLER
DEMONSTRATES
SAVING GENIUS



Eliminates use of expensive dowel holding devices. Vibrates dowels and tie-bars to exact position in plastic concrete; forms transverse joints and cuts and installs longitudinal joints . . . all in one operation.

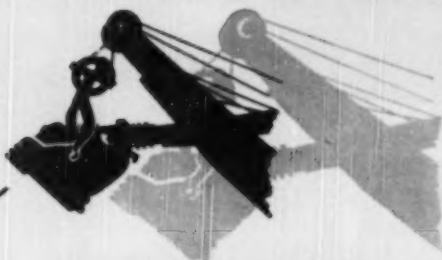
It has made money for other contractors. Before you bid, investigate the Flex-Plane Mechanical Bar Installer.



FLEX-PLANE
WARREN OHIO

(FLEXIBLE ROAD JOINT MACHINE CO.)

Write for Bulletin K-10-Q



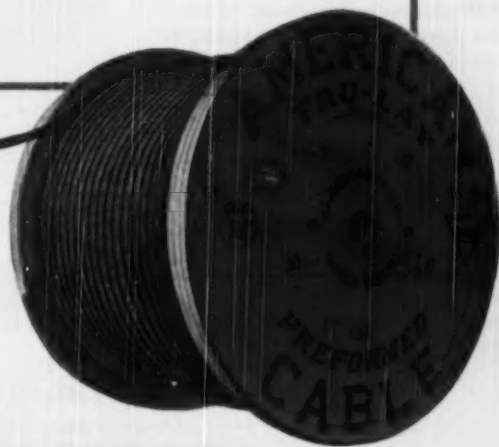
TRU-LAY...

The Wire Rope Name that means most value...

... in length of service ... in ease of handling ... in adaptability to all working conditions ... in lower operating costs ... in all the ways that prove to a user that his wire rope dollar goes further when he buys TRU-LAY.

TRU-LAY Wire Rope is preformed—and made by the men who originated preforming. Men with skills grown out of patient, conscientious, life-long devotion to wire rope. Men whose satisfaction lies in trying to improve what is already the best.

These are the extra advantages you get when you specify *TRU-LAY—THE WIRE ROPE NAME THAT MEANS MOST VALUE.*



ACCO

In Business for Your Safety



**AMERICAN CHAIN & CABLE
AMERICAN CABLE DIVISION**

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York,
Philadelphia, Pittsburgh, Portland, San Francisco, Seattle, Tacoma, Bridgeport, Conn.

TOUGH MOUNTAIN HAULS

...a daily dish

HAULING 10½ bank yard loads of granite over mountain trails at altitudes up to 8300 feet is a real test of a Diesel engine's brute strength and stamina.

To see how General Motors Diesels take such work in stride, look at the record three LeTourneau Tournarockers, powered with GM Diesels, made for contractors Horner and Switzer on relocation of United States Highway 280 at Granby Dam, Colorado.

Checked on a haul of 1240 feet each way, including a 170-foot stretch of 13% adverse grade, each Tournarocker took only 4¼ minutes to travel, dump and return to shovel. Haul road conditions were poor due to heavy rainfall. Yet haul cycles were so fast that on most distances only two of the Tournarockers were needed to keep the 2½-yard rock shovel busy. Together, these three 16-ton units moved 220,000 yards of granite.

Here is self-evident recommendation of GM Diesel's powerful 2-cycle operation—power at every piston downstroke. It makes them compact, easy to start, quick on the pickup, clean burning and efficient at any altitude.

If you're interested in dependable power with rugged performance and low fuel costs, you'll want all the details about GM Diesels. See your distributor or drop us a line.



DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . . . Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS . . . Up to 600 H.P.
GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK





Formula for better roads and streets

●If underpowered, slow-moving equipment is retarding your road-building and maintenance program, you'll find the made-to-order solution in Marmon-Herrington *All-Wheel-Drive* Ford Trucks.

With front wheels pulling, rear wheels pushing, these great trucks have the sure-footed tractive power of crawler tractors, plus truly amazing speed and maneuverability. Masters of deep mud or sand, steep hills and grades, they accomplish toughest jobs with astonishing speed, ease and economy. And in winter they're the fastest, most efficient snow-removal trucks ever.

There are 30 Marmon-Herrington *All-Wheel-Drive* Ford models to choose from. Wheelbases range from 110" to 220"—G.V.W. from 5,300 lbs. to 35,000 lbs.—forward speeds from 4 to 10.

For a demonstration of the ultimate in performance-ability, see your Marmon-Herrington dealer—or write for literature.

MARMON-HERRINGTON COMPANY, INC. • INDIANAPOLIS 7, IND.

SERVICE AVAILABLE AT FORD DEALERS EVERYWHERE...



For the most part, Marmon-Herrington uses standard Ford parts in converting to *All-Wheel-Drive*. Consequently, fast, efficient, low-cost maintenance and repair service is available at Ford dealers everywhere. When, occasionally, special parts are required, they are quickly obtainable through Marmon-Herrington distributors, conveniently located in principal cities the world over.

MARMON-HERRINGTON
All-Wheel-Drive

FORDS

Only Adams

gives you this exclusive combination of advantages

1 8 Overlapping Forward Speeds . . . Flexible working range speeds work—increases output—provides high transport speeds.

2 **WIDE RANGE OF BLADE POSITIONS**

3 Positive-Action Mechanical Controls . . . Dependable, accurate adjustments—because they're geared . . . Easy, natural steering.

4 Ample Operating Clearances . . . Quick, easy adaption to work . . . Operator comfort, convenience, efficiency.

5 Fast, Easy Servicing Plus World-Wide Dealer Service . . . Saves time and money.



2 Wide Range of Blade Positions

Without Mechanical Adjustments...
Saves Time in Adapting Machine to Needed Cuts



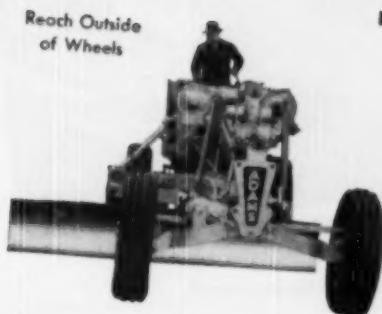
Ditch Cutting



Low Bank Sloping



High Bank Cutting



Reach Outside
of Wheels



Reverse Ditching
or Blading

On most construction work—ditching, low and high bank slopes, wide shoulder reach, etc.—the operator of an Adams Motor Grader obtains all necessary blade positions right from his station, without having to make any mechanical adjustments.

For example, all Adams Graders provide all of the positions shown above—and others—without shifting blade on circle or adjusting lift linkage. Only on occasional work, calling for extreme reach, is blade shifted on circle.

The ability of Adams Graders to provide such a wide range of blade positions—without mechanical adjustments—helps operators, always, to work at peak efficiency and produce more work per day.

This is one of the important features (see list on opposite page) that makes Adams the fastest, most efficient and economical motor graders on the market. See your local Adams dealer for full particulars.

L. R. ADAMS MANUFACTURING CO. • INDIANAPOLIS, INDIANA

*Make your next
motor grader an*

Adams

MORE WORK AT LOWER COST



Keep engines clean and efficient with **TEXACO URSA OIL X****

ASSURE trouble-free engine performance, and you'll get more work and longer working life from your machines. Maintenance costs and fuel consumption will be less, too. Use *Texaco Ursa Oil X***—the fully detergent and dispersive oil that cleans as it lubricates. Ideal for both heavy-duty gasoline and Diesel engines.

*Texaco Ursa Oil X*** strongly resists oxidation. This means rings stay free, valves act properly because engines are cleaner. *Texaco Ursa Oil X*** stands up under heat and pressure . . . gives full protection at all times . . . guards bearings against corrosion . . . assures longer life for moving parts.

Reduce Other Maintenance Costs

Use *Texaco Marfak* in chassis bearings—get extra hundreds of miles of protection, longer life for all chassis parts.

In wheel bearings, use *Texaco Marfak Heavy Duty*. It seals out dirt and moisture, requires no seasonal change.

Protect crawler track mechanisms with *Texaco Track Roll Lubricant*. It's remarkably long lasting, seals mechan-

isms against water and dirt, reduces wear.

Texaco has a Simplified Lubrication Plan that's a real money saver. Ask your Texaco Lubrication Engineer for full details. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

New Spreader and Vibrating Tamper

Place Stone Subbase and Macadam in Double-Thick Lifts

By C. F. Bond

Engineer-Manager
Dave L. Brown, Contractor,
Chattanooga, Tenn.

THE Chattanooga Municipal Airport has been completely reconstructed and improved to a Class IV field, as a part of the National Airport Plan of the Civil Aeronautics Administration, with co-operation of the City of Chattanooga.

The improvement consists of two new and longer runways, connecting taxiways, and concrete apron. The NNE-SSW runway is 150 by 6,200 ft. and the NW-SE runway is 150 by 5,000 ft. Runways have parallel 60-ft. taxiways. The concrete apron is 250 by 750 ft. The improvement involves more than \$2,500,000 which covered, besides the major construction contracts, lighting installation, seeding of shoulders and graded areas, and fencing of the field. The airport design was based on an E-6 Soil, F-3 condition, providing a gross loading of 90,000 lb.

In the interest of expediency and economy the improvement was let by the City of Chattanooga in three separate contracts:

Division I—Nello L. Teer, Contractors, Durham, N.C., covering clearing and grubbing, grading, and drainage. W. R. Burton, superintendent.

Division II—Dave L. Brown, Contractor, Chattanooga, Tenn., covering granular subbase, waterbound macadam base, bituminous surface course, grassing, and fencing. C. F. Bond, superintendent.

Division III—Anderson Electric Co., Spartanburg, S.C., covering lighting and underground cables.

Contractor at Chattanooga Airport spreads 5,000 tons of stone daily, placing subbase stone in 10½-in. lifts and waterbound macadam in 8-in. lifts compacted thickness

Grading and Drainage

The Division I, or Nello L. Teer, contract included the following approximate quantities:

148 acres of clearing and grubbing
1,425,000 cu. yd. common and borrow excavation
275,000 cu. yd. rock excavation
23,200 lin. ft. concrete pipe (15" to 60")
19,500 lin. ft. electrical duct

Work was begun in January and completed in December, 1949. The equipment included:

2 Northwest 80-D shovels
2 Northwest 25 draglines
1 Northwest 25 backhoe
14 Euclid 15-yd. bottom dumps

1 Euclid belt loader
4 Euclid 14-yd. side dumps
12 Caterpillar D-8 tractors
1 Le Tourneau scraper
4 Caterpillar No. 12 motor graders
2 gangs of three-unit sheepsfoot rollers
2 Jaeger 500 cfm. compressors
1 Ingersoll-Rand wagon drills
Also numerous other equipment such as service trucks, shop trucks and small tools

Specifications required 95% AASHTO density in the compacted subgrade. Time limit was 200 working days. Work was completed well within the scheduled time, despite inclement weather throughout.

Subbase, Base, Paving

The Division II or Dave L. Brown contract consisted mainly of the approximate quantities:

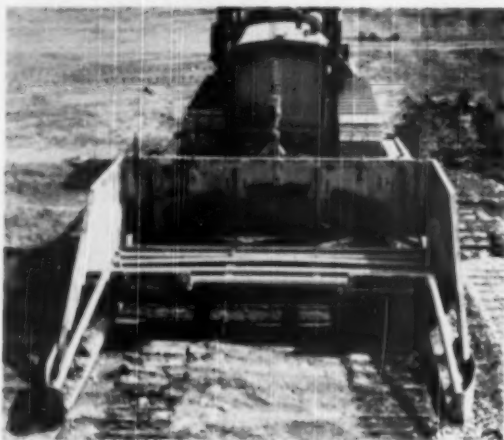
75,000 cu. yd. granular subbase
60,000 cu. yd. waterbound macadam base
34,000 tons hot-mixed asphaltic concrete surface course
22,000 cu. yd. portland cement concrete pavement (10½-in. thickness for concrete apron)



★ E. R. Justice, resident engineer; Dave L. Brown, contractor; Marion E. Boriss, city engineer of Chattanooga. Note thickness of spread materials in background



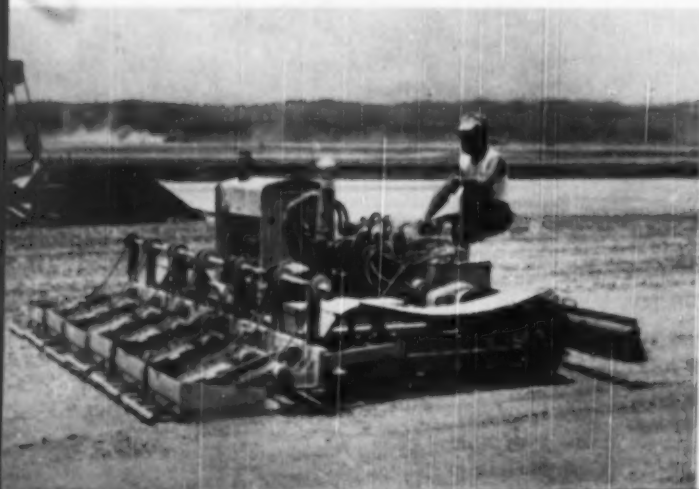
★ Euclid loader pulled by International TD24 and pushed by Caterpillar D8 loading 15 yd. in less than a minute. Euclid "bottom dumps" on the haul (At left below): Northwest shovel loading to Euclid.



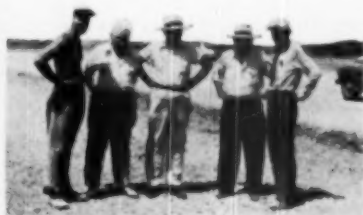
★ View of "Bond" spreader mounted on Caterpillar D8 bulldozer frame. Capacity 500 to 1000 tons per hour, spreading 5 to 15 in. deep and 11 ft. wide



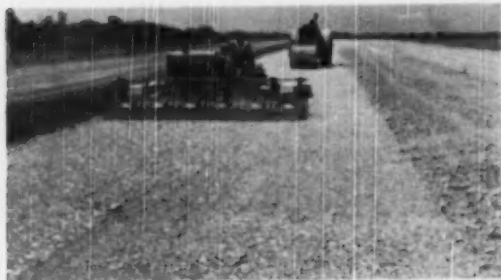
★ (Left): Lined up to feed the spreader KB-8 International's with 10-ton loads



★ "Vibro-tamper" compacting granular subbase immediately after spreading and blading



★ Seen on the Chattanooga job: R. G. Copper, inspector; Wm. P. Day, President, International Vibration Co.; J. A. Baker, planning engineer, CAA; E. R. Justice, resident engineer; Hal C. Branaman, asst. resident engineer



★ Closeup of tamper in action on subbase

300 acres seeding
12,000 lin. ft. fencing
Other facilities such as curb and gutter,
sidewalks, driveways, numbering and
marking

The granular subbase was designed for a maximum of 10 1/2 in. compacted thickness. Material first selected was a granular chert, the approved sources located 10 or 12 miles from the airport. An abundance of limestone suitable for the subbase was encountered during the grading, and subsequently used in lieu of the chert with great saving in hauling cost. It was stockpiled by the grading contractor for future use by the paving contractor, in 1/2 cu. yd. maximum size convenient for crushing.

A crushing plant erected on the site processed the stockpiled stone. Specifications P-154, Type B Subbase, required 3 in. maximum size, not more than 70% passing 40 mesh, liquid limit of less than 30 and plasticity index of less than 8.

High clay content of the materials governed the selection of crushing equipment, which consisted of a 50" x 50" New Holland impeller crusher, with 4' x 12' vibrating screen; also used were a 100-ton bin, 30-in. belt conveyors, Mack rock trucks, and Lorain 2-yd. shovel.

Subbase Details

It was planned to take the subbase material from the bin as crushed and haul direct to the runways and taxiways, to be spread in one layer and compacted to the proper thickness. Approval for this unusual procedure was obtained from the con-

sulting engineers and from CAA, through the medium of a change order. This approval was based on proper tests and experiments to determine the best methods to spread in one course, after which a spreader box was built to provide a spread width of 11 ft. and a spread thickness of 5 to 15 in., these being the limits of thicknesses desired.

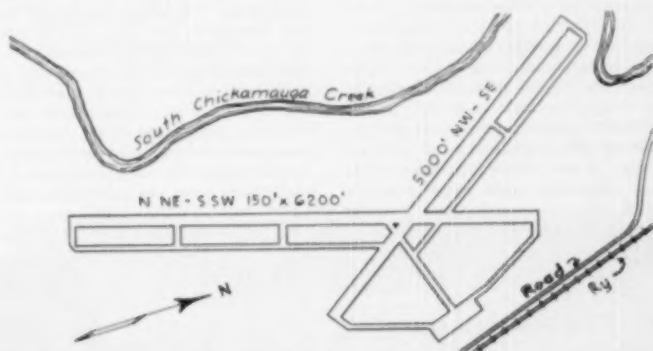
The spreader box devised, a large one mounted on a Caterpillar D8 dozer, demonstrated for this project a capacity of more than 10,000 tons per day of stone spread in one layer. This type of spreader box was not entirely new to the writer, as he had constructed several airports during the war years, and a similar spreader box had previously been built and used to expedite the work. But no spreader box had previously been at-

tempted in these proportions, to his knowledge.

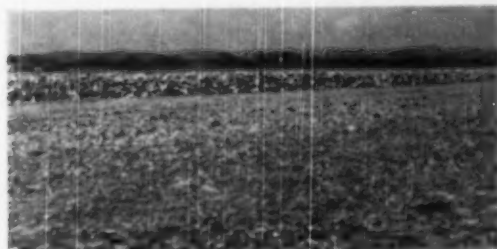
The problem of spreading was solved with the spreader box. However, the compaction of bases of 10 1/2 in. compacted thickness in one layer had not been attempted heretofore and a new piece of equipment, the Vibro-Tamper (International Vibration Co.) was employed to do the job. This unit is self-propelled, crawler mounted, and has a tamping mechanism consisting of six vibrating shoes, each 2 ft. wide by 16 in. long, mounted on a horizontal frame. The ground contact of each shoe is approximately 1.5 sq. ft. and the weight 300 lb., with unbalance weights in each shoe providing 16.0 lb.-in. at a vibrating speed of 2,800 rpm. The weight of the machine is 6,600 lb. The actual amplitude of vibration varies with the na-



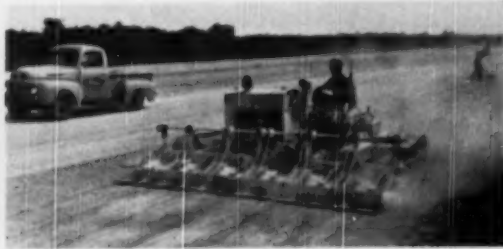
★ Completed waterbound macadam base on SSW runway



★ Layout of new 2-runway improvement



★ View of coarse aggregate for the waterbound macadam base, spread full thickness. Note uniformity of thickness



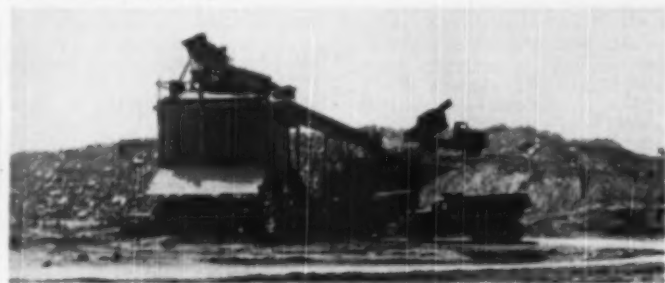
★ Tamper working fine aggregate into the coarse aggregate of the waterbound macadam base



★ View of the 50 x 50 New Holland crusher and plant. Mack rock trucks dumping into feeder. Note full conveyor. Capacity better than 500 tons per hour



★ Lorain shovel loading Mack rock truck from the stockpile of uncrushed subbase material



★ Another view of crushing plant, screens, bins, conveyors, loading and hauling equipment at the stockpile of uncrushed subbase material

ture of the surface on which the shoe is vibrating, a hard surface giving a greater bouncing effect, which is lessened on a softer surface.

The crushing plant used in producing the granular subbase material had a capacity of more than 6,000 tons per 10-hr. day and with the spreader box and vibrating tamper no difficulty was experienced in completing large quantities of subbase daily. It was found by actual tests and experience that these methods employed produce a subbase superior to the conventional two-layer methods, in that a higher density was obtained throughout the full thickness of the subbase.

W.B. Macadam Base

The waterbound macadam base was designed for 8 in. max. compacted thickness and was produced from a limestone quarry located at the north end of field. Materials used were in accordance with CAA Specifications P-206, the coarse aggregate being modified (by special provisions) to include 2 1/2-in. maximum size instead of 3-in. The coarse aggregate ranged from 2 1/2 in. to 3/4 in., the screenings being 3/4 in. to minus 100 mesh.

A separate complete crushing plant was erected at the quarry site to produce macadam stone and aggregates for the bituminous surface courses.

It consisted of an Austin-Western 25 x 40 jaw crusher, Pioneer Triple Roll crusher, Gruendler pulverizer, 4' x 12' triple-deck vibrating screen, 30-in. belt conveyors and bins. The crushers were powered with General Motors and Caterpillar diesel power units, and the conveyors used electric motors. Quarry equipment consisted of two Mack rock trucks, a Northwest 80-D shovel, Sullivan (Joy) compressors and Ingersoll wagon drills. This plant produced more than 3,500 tons of crushed limestone per day. Materials were taken directly

from the bins to the runways and taxiways or asphalt plant.

The methods and equipment used on the subbase were also used for the macadam base, including the special spreader box and the vibrating tamper; again coarse aggregate was spread to full thickness in a single layer, and after blading to correct any irregularities, was keyed by passing the tamper over, then compacting further with a 3-wheel roller.

Screenings were applied evenly and gradually over the coarse aggregate, in three approximately equal applications, and the tamper used with each application of screenings. It was found that this method completely filled the interstices. After sprinkling the surface, the 3-wheel roller was used to set and bond the surface.

Tests indicate that the single-layer method of placement with compaction and application of screenings, as here described, produced a base superior to the conventional method of 4-in. layers; it resulted in higher densities, more completely filled voids, elimination of the sealed plane necessary in the multiple layers.

A minimum of labor and equipment



★ One of the Mack trucks dumping a load of limestone into the feeder at the quarry and crusher site. Inspector Martin and Contractor Lambert on right



★ Views of crushing plant used in producing the waterbound macadam base aggregates and bituminous surface course aggregates. 25 x 40 Austin-Western primary crusher; 40 x 22 Pioneer Triple Roll secondary crusher; SXE Grindler hammer-mill; 5' x 12' triple-deck SECO Screen. Caterpillar and General Motors power units. Capacity in excess of 350 tons per hour



★ 40 x 22 Pioneer Triple Roll crusher and SXE Grindler Pulverizer in action

was needed with the new method, and rolling time was reduced by more than 50%. Density of as much as 137 lb. per cu. yd. was obtained with 38% screenings, this being in excess of rigid specification requirements. As much as 20% more screenings were absorbed by the coarse aggregate than is expected with conventional roller methods, thereby producing a denser base.

From the viewpoint of the contractor and superintendent this method of base construction has proven entirely satisfactory and considerably more economical, and has created "keen" interest among the many engineers and contractors of this section. Henry Aaron, Chief, Paving and Soils Branch, Airport Engineering Division, Civil Aeronautics Administration, Washington, D.C., stated that "results indicate the vibrating tamper will reduce both the cost of macadam construction and the length of time required to construct the given thickness of a base course."

While this airport project is the first known to officially include single-layer bases of 8 to 10 1/2 in. compacted thickness, with the use of the vibrating tamper, it is believed from the conclusive results that the methods offer similar advantages in base construction elsewhere.

(See the "Bituminous Roads and Streets" section of this issue for a brief description of the asphaltic concrete binder and surface course which completed the runways and taxiways.)

The crushing of all aggregate for



the subbase, base and surface course was sub-let to Lambert Bros., Inc., of Knoxville, Tenn.

Concrete Apron

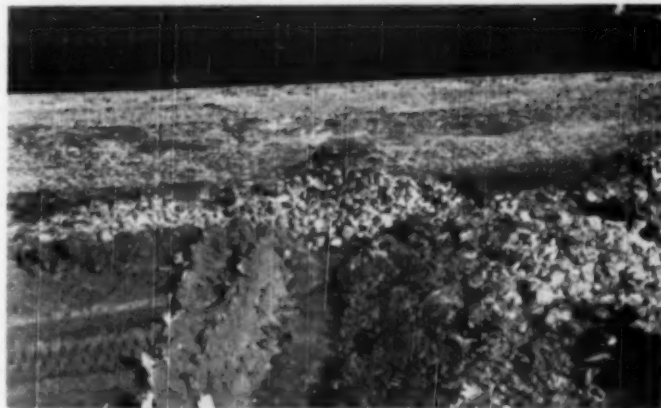
The concrete apron (250'x750'x10") was constructed in sections of 250 ft. in length in order to utilize the existing runways until new sections of runways and taxiways could be completed and placed in service. It was necessary to complete the

south end of the new airport and place it in service before the north end of the old airport could be abandoned and rebuilt.

Ready-mixed air-entraining concrete for the apron was supplied from downtown Chattanooga at the rate of about 200 cu. yd. daily.

The lanes were concreted in widths of 12 1/2 ft. using a keyed construction joint, since the 250-ft. limit on sec-

(Continued on page 65)



★ Showing effectiveness of the granular subbase. Note water draining from the base in the ditch in foreground



Wartime Chief of Engineers

The new "top man" at the American Road Builders' Association, General Reybold, is the man who as Chief of Engineers of the U. S. Army headed up the greatest construction job in the world's history . . . over half a million engineer troop personnel . . . the Alcan highway . . . millions of feet of runways . . . army installations by the hundreds of square miles . . . fuel pipe lines across Europe . . . the bulldozer and tractor becoming a symbol of the American technology which won the war

General Reybold Appointed To Head Road Builders

A DISTINGUISHED career in two branches of the Army and during both World Wars lies behind Lt. Gen. Eugene Reybold, who, on April 15, was appointed executive vice-president of American Road Builders' Association, the country's oldest national good roads group.

Awarded the Distinguished Service Medal in World War I and accorded similar honor in the form of an Oak Leaf Cluster in World War II, General Reybold's contribution as an administrator and a builder is described graphically in this last-named citation. In addition to crediting him with "exceptionally meritorious and distinguished service in a position of great responsibility," the citation lauds his "outstanding leadership, unlimited energy, good judgment and sound decisions," and declares:

"General Reybold contributed outstandingly to the military successes of this country and to the health and comfort of both the American soldier and American citizen. This he did through speeding the eleven-billion-dollar military construction program which was the foundation for training and producing for war; through the recruitment and training of skilled specialists to perform the innumerable engineering responsibilities in the Theaters of Operations; through

the acquisition of millions of acres of land without delay or serious inconveniences to the civilian population; through the performance of the repair and utilities functions at military posts, camps and stations having at one time a military population of 5,300,000; and through the development, procurement, storage and issue of billions of dollars worth of engineer supplies and equipment.

In addition to these heavy wartime responsibilities and without delaying the military work of the Corps of Engineers, he supervised the maintenance work on the nation's vast flood control and river and harbor improvements, the construction of large civil works projects deemed essential to the war effort, and the advanced planning of a tremendous post-war civil works program. While maintaining a most excellent relationship with other headquarters, with his field agencies and with the public, General Reybold demonstrated exceptional initiative, foresight, wise planning and persevering devotion to duty in a way that welded the diversified activities of the Corps of Engineers into a firm, efficient and effective organization."

General Reybold at the end of World War I held temporary rank of Colonel, then reverted to permanent rank as captain.

During his Army service, he spent seven years in domestic and Philippine duty; 7½ years at Fort Monroe, Va., as a student, instructor, later as director of the Department of Enlisted Specialists at the Coast Artillery school, then as Commandant of the Coast Artillery school, and finally as Constructing Quartermaster in supervising construction at several posts. Subsequently he was ordered to Fort Leavenworth as a student at the Command and General Staff school, and after graduation spent three years as an instructor at the General Service schools there, and later attended the Army War College.

Broad Civic Experience

Subsequent tours of duty found him serving five years as Assistant District Engineer, and then as District Engineer at Buffalo, N. Y., charged with responsibility for river and harbor work on Lakes Erie and Ontario and on the Niagara and St. Lawrence Rivers. He also served as a member of the U. S. section of the International Board on the proposed St. Lawrence navigation and power project. He returned to Washington to serve nearly a year in the office of the Chief of Engineers with the Board of Engineers for Rivers and Harbors; then as District Engineer for the Corps at Wilmington, N. C., and in April of 1935 he went to Memphis, Tenn., in a similar capacity there.

In mid-1937, he was ordered to Little Rock, Ark., to organize the Corps' Southwestern Division with the title of Division Engineer. In the three years that followed, he wrote a record of major achievement which won the outspoken appreciation of civic and commercial leaders. Comprehensive flood control plans for the Arkansas and White Rivers were set up, and construction projects totaling \$430 million were started, authorized or recommended to Congress during his tenure.

Again he was called to Washington, this time as Acting Assistant Chief of Staff, Supply Division, on the War Department General Staff. A year later, in September of 1941, he was assigned to the office of the Chief of Engineers as Acting Chief. He succeeded to the office of Chief of Engineers in October, 1941. He retired from active duty in January, 1946.

He holds the degree of Doctor of Engineering, conferred upon him by the University of Delaware in 1941; and Doctor of Science Degrees from University of Arkansas (1942) and Drexel Institute of Technology (1943).

★ Are Policies or Politics to Blame?

Were it not for the fact that the engineers of the State Road Commission of Utah are friends of the writer, he could not say what follows:

About 4 or 5 miles west of the west border of the Cedar Breaks on the west side of the Uintah Basin in Utah a most disgraceful condition on US 40 exists at this writing where a construction job was stopped last fall. For about 300 ft. in a cut where the contractor left the job unfinished the

road is extremely rough and bumpy, dangerously so, with no provision for drainage or for halfway decent travel. The place was a loblolly when the writer passed through it on the 3rd of April. This was our second trip over this spot this spring.

There appeared to be a possible detour; yet no barricades or signs were erected at either end of the possible detour to warn traffic of the

dangerous condition in the cut, or to keep traffic out of the cut.

US 40 is one of the main traveled routes across the United States.

Because of the myriad of other broken up places, pot-holes, corrugations, narrow places, and generally inferior road conditions on this route in Utah, east of Salt Lake City, the writer recommends travelers to avoid this route, if possible.

★ The High Cost of Job Stoppages

One of the subjects that came out in the contractor panel discussion at the Texas short course recently, was the cost of delays on today's complex highway projects. Particularly on urban projects, where various operations, each beset with many potential delays, must be highly coordinated, the cost of calling a crew to a halt for some purpose means a lot of money to the contractor. The engineer in charge often doesn't realize the big stakes involved on the con-

tractor's side in such stoppages.

The time sequence of each operation and even sub-operation must be plotted carefully in advance, and a good superintendent in the last analysis is the one who plans so well that everything goes along on schedule.

W. G. Staggs of J. M. Dinninger, Inc., in Texas, who brought out this point, suggested that all young engineers ought to get experience on "both sides of the fence" before fi-

nally settling down to a career in the highway department. While admitting that this is not always accomplished, Mr. Staggs himself is an example of a contractor who was formerly an engineer. The good works both ways.

The immediate answer is for everyone to get together before the job begins, and work out a time schedule so that both the engineer in charge and the contractor's superintendent will understand each other's needs and problems.

★ Engineer Estimates and Contractor Bids

One of the advantages frequently cited for concealing the engineer's estimate until bids are received is that a contractor is forced to bid the job rather than the estimate.

It is, therefore, surprising to note a slight trend in Ohio to place an over-emphasis on an engineer's estimate as a basis for an award of a contract.

An engineer's estimate at the best is only a yardstick based on past history. The contractor's bid is based upon a thorough analysis of the work involved, taking into consideration the future in prices of materials and labor. Unless the market is extremely stable, there will always be differences between the engineer's estimate and the contractor's bid. This was apparent in 1946 where, in a rising market, the engineer's estimates were below the contractor bids and in the present

situation, when we are falling away from a peak in prices, where the engineer's estimates are uniformly higher than the contractor's bid.

Another point that should be remembered is that, aside from the foregoing, the engineer's estimate does not always truly reflect the risk and hazards involved in a job. A contractor is necessarily more responsive to these elements than the engineer. Where there is a decided variation in the bid from the engineer's estimate, it does not necessarily mean, therefore, that the contractor is wrong. There is also a very definite possibility that the engineer's estimate has failed to reflect all elements involved in the job.

Awarding authorities would do well to call in the contractor when an element of doubt exists regarding his prices rather than to arbitrarily re-

ject bids because of variation from the engineer's estimate, for the contractor is only doing what concealed bids were supposed to accomplish, i.e., bidding the job rather than the estimate. If now it is determined that all contractor bids must be a certain percentage below the engineer's estimate, and we hope this is not true, then the principal argument for concealed estimates is void.

However, if engineers are trying to establish the going market price for certain work, they might better take the average of all bids submitted on a particular project rather than the low bid.

(Editorial in "Ohio Public Works," published by Ohio Contractors Association, Charles E. McKee, Editor)



★ General view showing H-beam piling in place, with general excavation work in progress preparatory to placing selected backfill material

Herein is recounted the history of a trouble-making highway along the Ohio River, and various remedies used by the highway department

Piles Into Rock

Help Stabilize Slide Area in Ohio

By H. L. Krauser

Assistant Engineer, Bureau of Construction,
Ohio Department of Highways, Columbus

THE historic Ohio River flood of 1937 has been properly documented as the worst one that ever occurred along this ordinarily placid stream. For the first time the stream was above flood stage for its entire length from Pittsburgh to Cairo. The relentless onrushing waters engulfed cities and farmland alike, people were made homeless and countless millions of dollars of damage resulted.

The Ohio department of highways was one of the many public agencies which suffered considerable loss due to the inundation of hundreds of miles of roads. Teams of engineers followed the receding waters and began the task of estimating the damage and the

cost of corrective measures.

State Route No. 7 between Miller in Lawrence County and Crown City in adjacent Gallia County meandered along the top of the river bank at the foot of precipitous hills. The elevation of the road was such that it was flooded for its entire length of four miles and at several particularly vulnerable places the river had undermined and washed out the road.

Relocation Details

A thorough investigation indicated the advisability of a relocation onto a fairly uniform rock ledge about 50 ft. above the present road. Core drillings at frequent intervals located the outer edge and thickness of the ledge and the center line was located accordingly.

A roadway width of 38 ft. was specified with a 22-ft. bituminous surface treated pavement on 6 in. depth of aggregate stabilized with binder soil. Variable back-slopes were required which were dependent upon the type of material encountered in the excavation. The embankment slopes were treated in a similar manner.

An undulating grade line was specified with cross road drainage culverts at numerous ravines. At the project extremities large embankment areas were provided so that a gradual ascent from and descent to the old road could be effected.

The location of the center line was such that the pavement area for the most part would lie on the solid rock ledge. In certain small areas where the irregularity of the outer face of



★ Views taken before and after work was started and completed at ramp area near the south end of the project

the ledge indicated a lack of this type of bearing, rock walls of a type shown in the accompanying photograph were required. These walls were seated on solid rock.

In other more extensive areas, where the berm on the downhill side would not rest wholly on the rock ledge a dumped rock embankment on previously prepared benches was specified. The plans provided for the embankment to be placed in lifts of 3 ft. or less and that all rocks should have their greatest dimension not more than $1\frac{1}{2}$ times the least dimension. Rolling was not required but keying was specified.

Bids were received on this work in November, 1939, and the job was begun by A. J. Baltes, Inc., of Norwalk, Ohio, the low bidder, in January, 1940. The contract price was approximately \$352,000.

At one area near the county line the weight of a long, thin embankment section caused a slide in the supporting ground which extended to the flat "bottom" land at about 500 ft. from the center of the road. It was decided to use the large quantity of waste excavation to place a blanket of embankment over the entire area beginning at the stable "bottom land." With the quantity of waste available a uniform blanket of 10 ft. was placed. It was estimated that the vertical component of the weight of this material would



★ View showing completed section of gravity concrete wall. Note that the location of the wall is such that the alignment of the guard rail is continuous

exceed the sliding tendency. This proved to be correct and stability was obtained.

Work was completed and this project was accepted by the state Highway department in December, 1941.

New Trouble Begins

During 1942 it became apparent that the supporting ground in the areas where dumped rock embankment was placed did not have sufficient stability. As a result, slips away from the road occurred and it was necessary for the state highway maintenance bureau to perform frequent and extensive work in order to keep the road open.

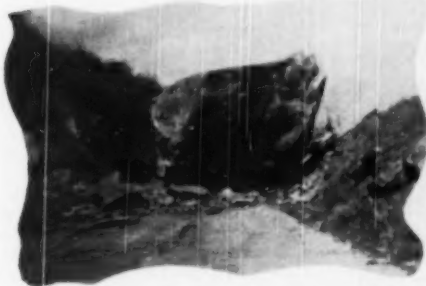
Slides onto the road from higher elevations made ditch maintenance a sizable problem. Late in 1944 a major slide occurred about midway of the project which completely blocked the road. Approximately 75,000 cu. yd. of rock and earth was moved before the road could be opened to traffic.

Soon after this, the ramp connecting the old and new roads at the south end of the original project settled approximately 10 ft. due to the failure of the ground upon which the embankment had been placed. This settlement engulfed the entire roadway area and traffic was again detoured for a long period while temporary repairs were made.

It was at about this time that a course of action was determined which resulted in an expenditure of about \$200,000 for permanent installations to prevent subsequent recurrence of slips.

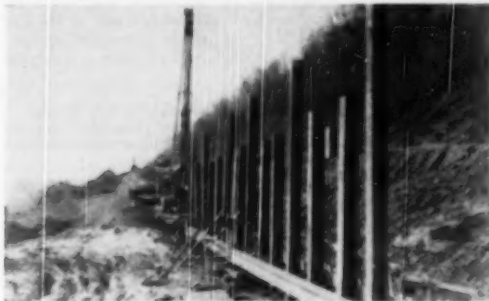
Special Problem Described

Plans were prepared which provided for relocations in two areas so that the entire roadway would rest on the rock ledge. In other areas it was determined that gravity concrete walls resting on solid rock could be built more economically.



★ One of the numerous large rocks which fell onto the road. This particular rock contained 800 cu. yd.

★ (Left): Showing general layout of drilling outfit and H-beam piling, which have been set in 16 in. holes and were later encased in concrete. (Right): View of H-beam piling with channel welded in place along outer face near the tops of the piles for alignment purposes. Higher piles have brackets for guard rail. The concrete pads at the ground line are bedded in rock. The precast concrete stretchers are seated on the flat areas shown on the near sides of the pads





★ Rock wall used to contain the roadway embankment. Varying heights result from irregular elevations at which solid rock was encountered. Wall is seated on solid rock for its entire length

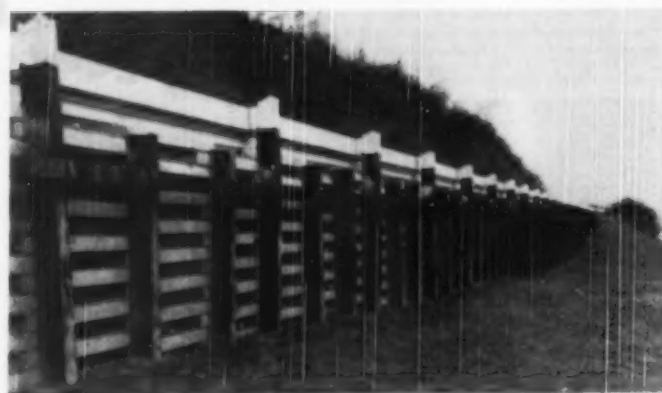
★ View showing partially completed gravity concrete wall. In some cases it was necessary to go to depth of 25 ft. in order to bed the wall on solid rock

★ General view of roadway in area where H-beam piling wall was constructed. Hub-guard in place below guard rail



One area, about 500 ft. long, near the south end of the proposed project, presented a particularly difficult problem. The original ground had failed to support the dumped rock embankment placed under the previous contract operations. Solid rock was too far below the grade line to make a concrete wall feasible. It was economically not feasible to relocate because of the quantity of excavation that would be involved.

It was decided to provide a retaining wall of steel H-beam piling parallel with and 18 ft. from the center line. After the slip material was removed and the solid rock was uncovered, holes were drilled into the rock to such a depth that one-third of the length of the 10 in. WF @ 89# H-beam piles used were in rock. Holes were spaced at 5 ft. c. to c. After each pile was placed the hole was completely filled with concrete and a concrete pad or cap was placed around the pile at the top of the rock. From this point upward alternate courses of precast concrete



★ Close up view showing free-draining rock backfill used in connection with H-beam piling wall. All structural steel was heavily waterproofed

★ View of H-beam piling wall complete except for guard rail. Note good alignment obtained

★ Recent view of completed H-beam piling wall. Note the undulations in ground surface in front

"Interest, Support, Loyalty, Friendship and Criticism" Describe

Utah Conference

CHARACTERISTICALLY, the Eleventh Annual Highway Engineering Conference of the University of Utah—held March 29-31 under direction of Prof. A. Diefendorf, his associate Prof. R. L. Sloane, and their assistants—included pertinent subjects discussed by qualified speakers on highway problems. Two of the outstanding papers were as follows:

(1) "Highway Maintenance Problems," by H. A. Radzikowski, chief maintenance branch, Bureau of Public Roads, Washington, D.C., and

(2) "Highway Maintenance Problems in Utah," by R. W. Griffin, construction engineer, Utah State Roads Commission.

These papers pointed out how highway construction and maintenance is fighting a rapidly losing battle against traffic growth. And this is particularly true in Utah. Frankly, one might constructively criticize the condition of Utah's roads as antiquated and in sorry shape. The engineers know it, they know they are losing the battle with traffic and weather. These two papers merely proved how and why.

Another paper which will be welcomed by the highway fraternity, particularly those engineers who have to deal with soils, was the talk by A. W.

Johnson, Engineer of Soils and Foundations, Highway Research Board, Washington, D.C., on the subject, "Using What We Know About Soils in Building Our Roads." Mr. Johnson discussed the judgment factors involved in using soils test data and other applicable soils information. He closed the gap between cold test data and what to do with the soils under consideration. This subject is worth further development and exposition.

Under the heading of "High Speed Equipment in Road Building," R. G. LeTourneau, president of R. G. LeTourneau, Inc., Peoria, Ill., discussed the development of earth moving equipment from the day of the team and wagon, the first tractor and scraper, to the present equipment operating at high speeds on pneumatic tires.

All conference meetings were well attended, showing the good judgment employed in selecting subjects and speakers. In addition to those mentioned above, the following papers were delivered:

(1) "The Contracting Industry Studies the Huge Construction Job Ahead," by A. N. Carter, Manager, Highway Division, Associated General Contractors, Inc.

(2) "Trends in Street and Highway Lighting," by R. J. Swackhamer, Light-

ing Engineer, General Electric Co.

(3) "Development of Power Shovel Industry," by Jack H. Sackett, Bucyrus-Erie Co.

(4) "Good Practices for Concrete Pavement Construction," by A. A. Anderson, Manager, Highway Bureau, Portland Cement Association.

(5) "Surveying Practice With Modern Instruments," by H. S. Wahlen, U.S. Representative Kern Company of Switzerland, San Mateo, Calif.

(6) "Land Use Planning," by J. E. Wiley, Public Relations Engineer, State Highway Dept., Wyoming.

(7) "Roadside Control and the Outdoor Advertiser," by Ellis L. Mathes, Traffic Engineer, Idaho Bureau of Highways.

(8) "Adequacy in Original Tire Equipment," by Thomas Callaway, Asst. to the Vice President, Goodyear Tire and Rubber Co.

(9) "Speed Versus Safety and Economy on the Highway," by Ralph A. Moyer, Research Engineer, Institute of Transportation and Traffic Engineering, University of California.

(10) "Highway Construction Procedures in Colorado," by W. J. Walsh, Staff Construction Engineer, Colorado State Highway Dept.

(11) "The Small Town Problem With Relation to the Location of Principal Highways in New Mexico," by B. G. Dwyre, New Mexico State Highway Engineer (read by proxy).

(12) "Considerations in Geometric Design to Reduce Truck Accidents and Congestion," by Edwin L. Mills, Highway Traffic Engineer, Western Highway Institute.

(13) "Principles of Air-Entrained Concrete," by Preston D. Linford, instructor in Civil Engineering, University of Utah.

Greatest attendance, of course, was at the annual banquet which filled the auditorium. Edward McPaul, Northwestern University, Chicago, was the banquet speaker. One disheartening factor noted was the lack of contractors, in numbers, in attendance. The old standbys were present, but there should have been dozens more.

This reporter wants to congratulate the financial backers of this conference for their support. If time will be taken to check on other states it will be found that in at least three others conferences have followed the lead set by this one in the Western States.

This report would be incomplete without mention of the numerous discussions in hallways and hotel rooms critical of the State of Utah in regard to salary scales paid to their loyal engineering staff. The lousy pay scales in the Utah Road Commission was amply described by an exhibit of a garbage can and a man. On the garbage can was the figure "1," on the man, the figure "4." A caption to the picture could read, "With one year's experience a garbage collector draws more income than a highway engineer with four years of college training."

stretchers, 8 in. by 6 in. by 6 ft., were placed against the inside face of the H-beam piling. The top course of stretchers was at a level of about 12 in. below the road surface. To provide greater stability the wall was anchored at 15 ft. intervals by means of 1½ in. steel rods, welded to the wall on one end and to anchor piles seated in rock beneath the ditch line on the opposite side of the road. Waterproofing of all structural steel in contact with rock or earth surfaces was provided. Backfill for the area where the slip material was removed was of rock. The position of the wall was such that the alignment of the guard rail which was fastened to it was continuous and symmetrical about the center line.

In order to assure the stability of the settled ramp area near the south end of the project, a superimposed blanket of excess excavation was proposed similar to that used at the County line for a similar purpose. Bids

were received for this work in February, 1948, and the job begun in May, 1948, by H. B. Hune & Harley E. Calvin & Co., of Marietta, Ohio.

Progress was hampered by two large rock slides on the road, for the removal of which it was necessary to compensate the contractor on an extra work contract basis. However, the volume was used to good advantage as "blanket" material.

The work was completed and accepted in October, 1949, and it is believed that there will not be any further slips and settlement. Slides onto the road are neither foreseeable nor preventable in this type of terrain and any future trouble of this character will be met when and if it occurs. All of the work in connection with the two contract projects described was performed under the supervision of the bureau of construction of the Ohio department of highways, L. H. Wismar, chief engineer.

KNOCKIN' Out the Yardage

13-15,000 Cu. Yd. Daily Pace Maintained at Fort Worth Airport

SPENCER Construction Co., of Carrollton, Texas, spent 1949 completing a 1,700,000 cu. yd. grading job for Fort Worth International Airport. While a peak of about 15,000 cu. yd. daily was reached by the earthmoving fleet, it wasn't all "pie," due to record-breaking zero weather of the 1948-49 winter, and an exceptionally wet year in 1949.

Here are a few highlights of the job:

The much-discussed Fort Worth International Airport received CAA approval as the metropolitan field of the region to be a Class V airport on completion. It is located half way between Fort Worth and Dallas. Improvement is being financed by bond issue proceeds, city of Fort Worth, and by CAA federal-aid funds.

The project called for re-grading



★ Scrapers moved spoil piles left from drainage excavation. La Plant-Choate TS-300 motor scraper seen here

the old site of Midway Airport, built in 1941 and used during the war by the Navy; and replacing the old black-top runways with two new concrete runways 200' x 6400' and 150' x 6400';

a 150' x 4100' bituminous runway; extensive 75-ft. concrete taxi-ways; and a large central apron (see layout). Paving is in progress this year.

Grading and drainage work was let Dec. 1, 1948, under an \$800,000 contract, the unclassified excavation going for 29 cents. The Spencer organization cleaned up 95% of the yardage by the following October.

About 22,000 lin. ft. of drainage was added, consisting of concrete pipe 66" to 15", 500 lin. ft. of 6-in. open concrete tile French drains, 60 inlets, and berm drains of 12-in. concrete pipe with tight joints. Ponding is provided for at all inlets. All concrete storm pipe with over 15 ft. depth of backfill was cradled, using 500 cu. yd. of concrete for this purpose. Drain lines were backfilled with choice material and pneumatic tampers used. The upper part of trenches was compacted with a small tractor and single-drum



★ Showing the contractor's grading teams at work, consisting of dozer, motor grader and sheepfoot unit, with either wagons or self-propelled scrapers delivering from the cuts

sheepsfoot roller.

The largest cut was about 640,000 cu. yd., and stretched clear across the field. The largest fill was 878,000 cu. yd. Cuts ranged to 14 ft. depth and fills to 61 ft. During the height of the grading work over fifty pieces of equipment were employed—see tabulation.

The contractor was required to stockpile about 5,000 cu. yd. of salvaged rock asphalt mix from the old runways, along with separately stockpiled salvage gravel base aggregate totaling 63,000 cu. yd.

Extremes in soil and conditions were encountered. The south half of the field had generally good soil of E-3 or E-4 classification (CAA), while the north part included much clay ranging from E-7 to E-11 classifications, requiring placement in selected areas or in lower lifts of the deepest fills. About 25,000 cu. yd. of sandstone outcropping occurred in one area.

Four Earthmoving Teams

Grading work was set up under four equipment teams: scrapers, both trac-



★ Lorain dragline on drainage excavation



★ Some machines were push-loaded, some pull-loaded.
Allis-Chalmers AC-19 tractor

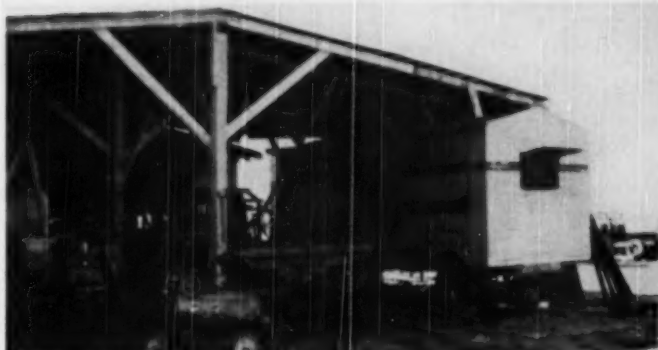
Contractor's Fleet at Ft. Worth Airport

(as of October 17, 1949)

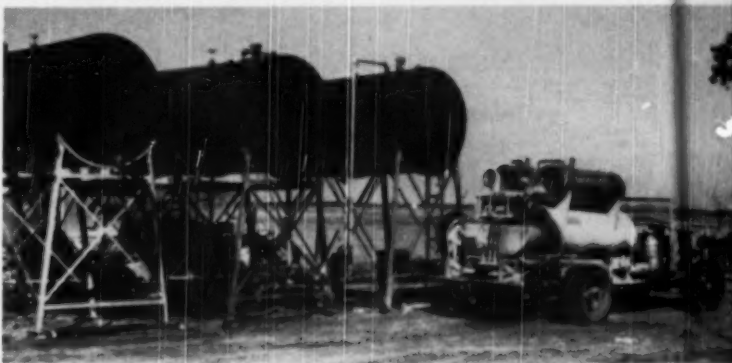
- 1 Marion dragline (2½ yd.)
- 2 Lorain draglines (¾ yd.)
- 1 Caterpillar elevating grader (drawn by D8)
- 2 LaPlant-Choate model TS-300 motor scrapers (14-yd. struck)
- 3 Tournapull Super C scraper (12 yd.)
- 3 Koehring Dumpsters (6 yd.)
- 5 Euclid bottom-dump wagons (12 yd.)
- 2 Caterpillar D8 tractors with 12-yd. scrapers
- 1 Allis-Chalmers HD-19 tractor-doxer
- 1 Allis-Chalmers HD-14 tractor
- 3 Caterpillar tractors (D8's)
- 5 Caterpillar tractors (D7's)
- 4 Ferguson Model 113, 4-drum sheepsfoot roller units
- 4 Caterpillar No. 12 motor graders
- 1 Allis-Chalmers motor grader
- 1 scarifier unit
- 9 contractor-built "bellydump" hauling wagons with Ford F-7 motors for use with elevating grader
- 1 heavy-duty ripper
- 1 Chicago Pneumatic compressor (220 cfm.)
- 2 water trucks (1000-gal. each)
- 2 4-in. water pumps (Rex, CMC)
- Small tools
- 1 complete shop
- 7 pneumatic tampers
- 2 Ford trucks (flat beds)
- 1 CMC 2-sack concrete mixer

tor-drawn and self-propelled; elevating grader and Euclid wagons; Marion dragline with Euclid's and bottom-dump special Ford trucks. The Tournapulls on the job were pull-loaded, the La Plant-Choate TS-300's Motor Scrapers push-loaded. Sprinkling was required much of the summer, and the bulk of the yardage was moved in months of June, July and August. The six self-propelled scrapers (Tournapulls and La Plant's) are credited with moving most of the dirt, the three La-Plant-Choate Motor Scrapers together averaging 3000 to 3500 cu. yd. per day

★ Placing concrete cradle for 54-inch concrete pipe storm sewer



★ Novel field shop arrangement used by Spencer Const. Co. at the Ft. Worth airport. Two shop trailers, equipped with parts and tool bins, etc., were stationed on either side of the entrance to an abandoned 2-car garage, making a 3-sided formation which was temporarily roofed over for weather protection. Bill Peck, shop foreman

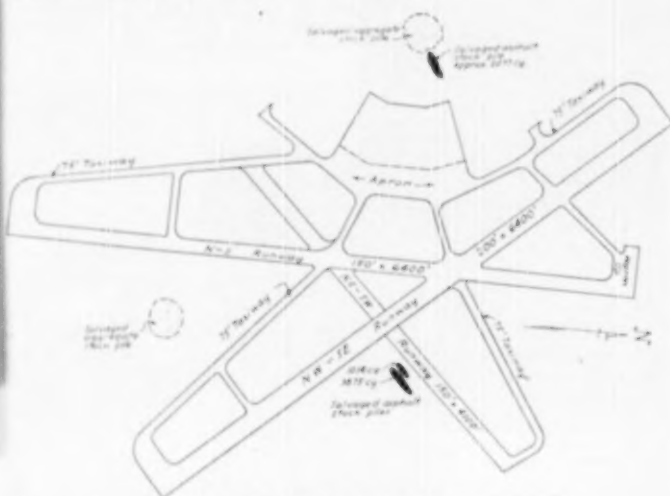


★ First two tanks are for diesel fuel, third for gasoline. Spencer's fuel and service truck is gassing up





★ Earthmoving plan sheet showing cut and fill areas



★ Layout of Fort Worth International Airport, showing the two new concrete runways and the runway to be paved from salvaged bituminous materials

under all conditions, according to the foreman.

The usual compaction requirement of 90% general and 95% under pavement areas (std. AASHO) prevailed.

An interesting detail during the earlier months was the use of the La Plant-Choate motor scrapers to remove spoil piles left by the draglines from drainage installation; the scrapers cut diagonally across the piles to clear the way for other operations.

All pavement areas were topped

out with at least 12 in. depth of E-7 or better soil.

All areas to be paved with concrete were blanketed with 12 in. of select material.

Four inches of topsoil was placed over the central area of the field.

Salvaging Old Asphalt

The existing runways to be torn up were 3 in number, each 150 x 4100 ft. long and built of rock asphalt and gravel. Despite the seven years' serv-

ice this pavement had given, it was decided to salvage and re-use all possible material in constructing the new 150' x 4100' runway. The plan was to re-work the material in an asphalt plant with the addition of necessary new bitumen, and machine-lay and roll the mix in June of 1950 when weather would be favorable for such an operation. The contractor carefully scarified and windrowed the top layer of runway surface over an area of 250,000 sq. yd., and hauled the material to three stockpile locations with scrapers. While the surface consisted of 1 1/2 in. depth of rock asphalt mix over compacted gravel, only about 1 1/4 in. depth of material was taken up as bituminous salvage, the remainder being classed as aggregate. Through careful effort by all concerned, the contractor succeeded in getting the good top stuff moved to the stockpiles in a condition declared "as clean as though just shipped in." Some of the gravel was left to the grading crew.

Fort Worth International Airport is under W. O. Jones, city manager, and C. M. Thelin, director of public works. W. A. Satterwhite is construction engineer and J. T. Matthews, resident engineer. Charles Estes was superintendent for Spencer Construction Company.

Chicago Needs 13,000 New Parking Space Units

The radial system of expressways under construction in Chicago, of which Congress Street to the west is farthest along, will heighten the daily concentration of traffic into the "Loop" district. Over 13,000 more parking space units will be needed by 1955 than are presently available, according to estimates submitted to the Mayor and council.

Seven new multi-storied garages to cost \$15,500,000 are urged in the report, which covers a 3-year study sponsored jointly by State Street merchants and the Association of Commerce. These garages would provide 5,234 spaces, and the structures would be built on city-purchased land and financed privately through revenue bonds. Present downtown space permits legal parking for 14,900 cars.

The following quantities have been estimated by assistant chief engineer C. H. Buckius of the Pennsylvania Department of Highways for the state's 1950, 110 million dollar road program.

Bituminous concrete, 1,305,634 tons; cement, 3,113,066 barrels; structural and reinforcing steel, 38,291 tons; bituminous material, 37,656,873 gallons; aggregates, 8,600,488 tons.

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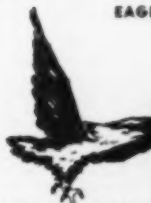
After loader is "on location" driver steps to running board where full hydraulic control of both loader and truck are within easy reach. Operator has best possible vision for safe, accurate, efficient operation of loader.

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★ Rear end of the machine used to finish the widening trench and facilitate laying of road forms drawing

Concrete Widening

Job Expedited by Special Equipment

Mechanical device for fine-grading and undercutting helped Louisiana contractor complete 2,000 lin. ft. of 3-ft. slab per day under 12,000 daily traffic

A SPECIAL fine-grading and undercutting machine helped make rapid progress on a pavement widening job in Louisiana last year. The project consisted of 6.7 miles of busy US 90 between Lake Charles and the suburban industrial town of Sulphur. The contractor was T. L. James & Company, of Ruston, La.

Traffic maintenance was one of the chief complicating problems. This section of the Houston-Beaumont-New Orleans coastal highway averages 12,000 vehicles daily, including many heavy trucks serving the area's oilfields and refineries.

The widening included a 3-ft. strip of concrete on either side of the existing 18-ft. concrete road, built in 1931 and undersealed in 1947. The widening slab design called for a bar reinforced sill under the edge of the old slab, and a thickness graduating from 8 in. at the outer edge to 6 in. thicker than the existing slab on the inner edge.

The old slab in this instance has an 8-6-8 cross-section.

Transit Mix Patches

For base patching the contractor employed transit-mixed concrete, patch areas being finished with a simple hand screed and long handled floats. New expansion joints consisting of 1-5/16 in. cypress boards were installed at 400-ft. intervals in the old pavement, and all joints sealed.

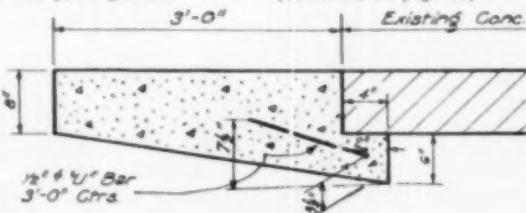
Excavating for the widening proceeded in the usual way, using a cater-

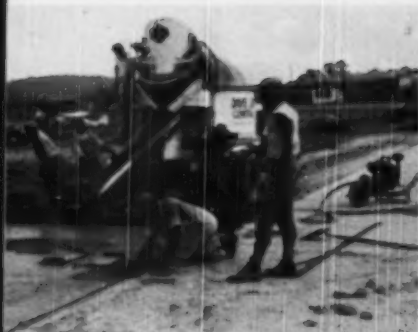
pillar No. 112 motor grader with a special mold board supplied by Special Equipment Co. of Austin, Texas. The blade operator rough-graded and threw a windrow of material out on the shoulder. This work, and in fact the entire job, was made easier by the existence of ample shoulder width to accommodate the widening. No culvert widening of consequence was required.

The trick was for the graderman to keep his blade always tight against the slab, so as not to leave a ribbon of material. He opened up only the length of trench estimated to be needed for the day's run, under the contractor's policy of completing each day's work section as he went along.

Widening operations were carried through the entire project on one side, (Continued on page 98)

★ Typical cross-section of the concrete widening slab





★ Work on the concrete apron—placing a 12.5 ft. width slab 10 in. thick. A Master vibrating screed performed the finish with flexible tube vibrator for the edges. Note minimum labor and equipment needed.

(Continued from page 53)
tion length made it uneconomical to use heavy full-lane finishing machines. The unit used was a 13-ft. Master vibrating screed. Only two finisher workers were necessary. The subbase consists of 8 in. compacted granular subbase such as used in the flexible runway design.

The time allowed for Division II work was 120 working days. Work was begun in June and largely completed in December, 1949, again despite adverse weather.

Chattanooga's new airport now serves growing traffic from three commercial air lines, two flying schools and private plane owners.

Acknowledgments

The Division III or electrical work was contracted to Anderson Electric Co., of Spartanburg, S.C., and consisted of 60 high intensity lights, 56 marker lights, 15 double obstruction lights, 24 special lights, 8 manhole vaults, and 100,000 ft. cable.

The engineering design for Chattanooga Municipal Airport was handled by the Harwood Beebe Company, Consulting Engineers, of Spartanburg, S.C., which firm also supervised construction, E. R. Justice being resident engineer, and Hal C. Branaman, assistant resident engineer. Testing work was handled by Froehling & Robertson, Inc., Inspection Engineers & Chemists, of Richmond, Va., under direction of J. M. George, with W. A. Blue and R. G. Cooper, inspectors. Representing Chattanooga were P. R. Olgiati, commissioner; Marion E. Borias, city engineer, and W. E. Eck-enrod, Jr., airport manager. The Civil Aeronautics Administration, Nashville District, was represented by William W. Johnson, Jr., district air port engineer, and J. A. Baker, district planning engineer.



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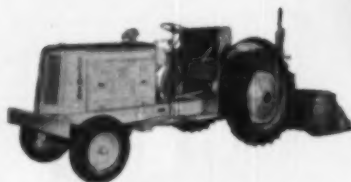
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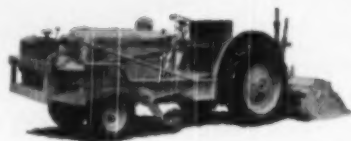
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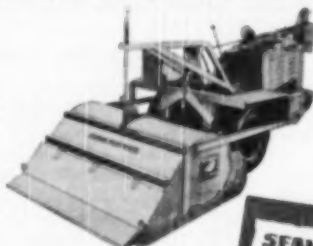
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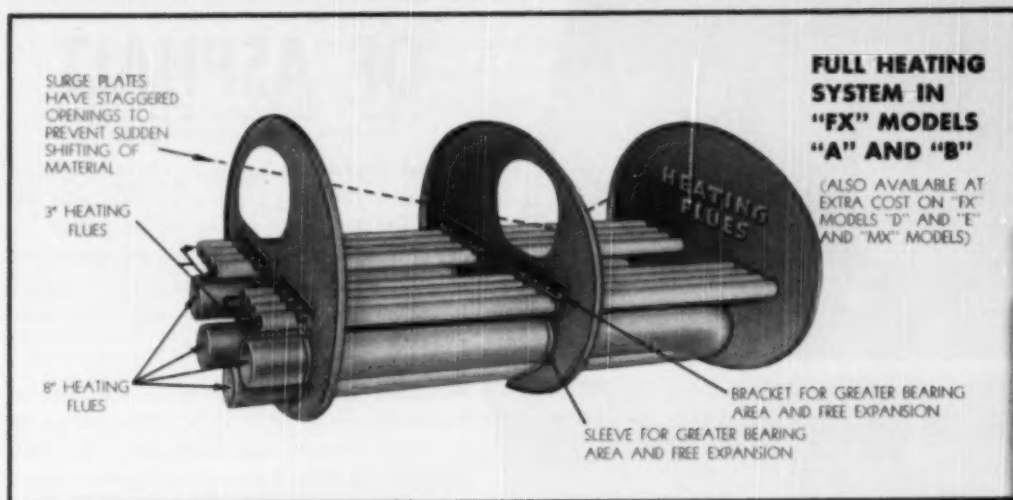
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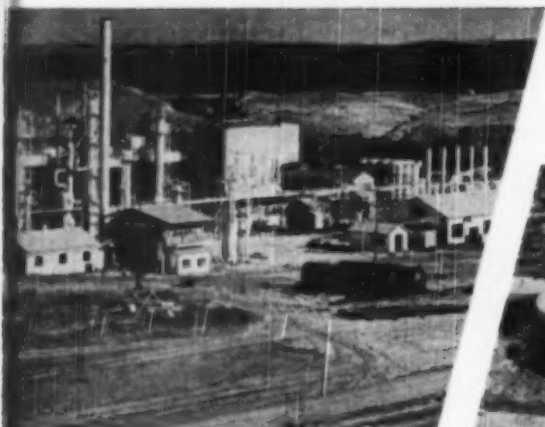


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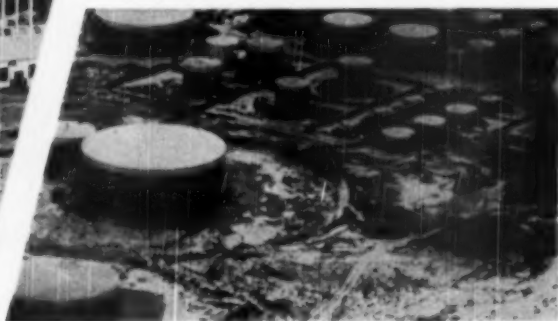
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The Case for Intermediate Bituminous Mixes

Greater attention to "in between" grades of bituminous road construction—utilizing heavier material grades and a central dryer and mixer, with machine laying—is suggested by this equipment engineer

By James E. Ward

Paving Engineer, Barber-Grass Company

INCREASED traffic density, higher load weights, and a greater demand for more mileage of roads have combined to create a need that is greater than the available funds.

Our many contacts with plans and practices in bituminous construction cover a broad range of conditions and solutions. Out of these contacts, we are able to report on a pattern of trends and results which at this time seems significant.

Between road-mix bituminous construction, and "I" type asphaltic concrete mixes, there is a vast field of "Intermediate" mixes, which can help materially to stretch the funds available for road construction and maintenance.

While hundreds of jobs, and thousands of miles of surface testify to the low cost and high quality of these "Intermediate" specifications, reports indicate that their use does not even approach their proportional merit. Here is a simple, flexible solution to some of the major problems of all who have the responsibility for road construction.

Many pavements are built of type "I" asphaltic concrete where the traffic would not require this quality for years, yet seal coats and road mixes are not adequate. The answer is in the use of the intermediate types.

All or Nothing

We believe we can report these current trends without bias. We recognize the quality of type "I" mixes and equally recognize the advantages of "road-mix." But reports from the field indicate that the choice of pavement is inclined to be restricted to an "all or nothing" basis.

There is no question about the high quality, long resistance, and long life of high-type bituminous pavements, which are derived from

four basic factors:

1. Quality of bitumen.
2. Dryness of aggregate.
3. Thoroughness of coating.
4. Gradation of the aggregate.

There is no question about the desirability of any of these four steps. All four are necessary to produce "I" type-mixes, but any one of these controls alone adds materially to the quality of the final pavement.

Three Instant Advantages

Merely by adding a dryer and accessories to the mixer you can obtain the first three factors.

1. You have a free choice of any bitumens.
2. You eliminate the greatest cause of pavement failure; that is, a high or questionable moisture content.
3. You have a heated bitumen which permits the use of heavy, high-quality bitumens with thorough, intimate coating.

True, accurate gradation control of the dried aggregate may not be employed, but, nevertheless, much quality is added over "road-mix."

As far as cost is concerned, there are many reports showing less cost per mile with central-plant produced intermediate-mixes than for road-

mix, and these comparisons are based on full seasons with each method. A number of factors contribute to the low cost of intermediate-plant mix. These include:

Longer Season: Central Plant operations, with mechanical drying, increase the length of the working season 30% to 40%. Hot-mix can be thoroughly mixed and laid at the lower temperatures of spring and fall. In addition, early spring and late fall work frequently encounters virtually impossible natural drying conditions.

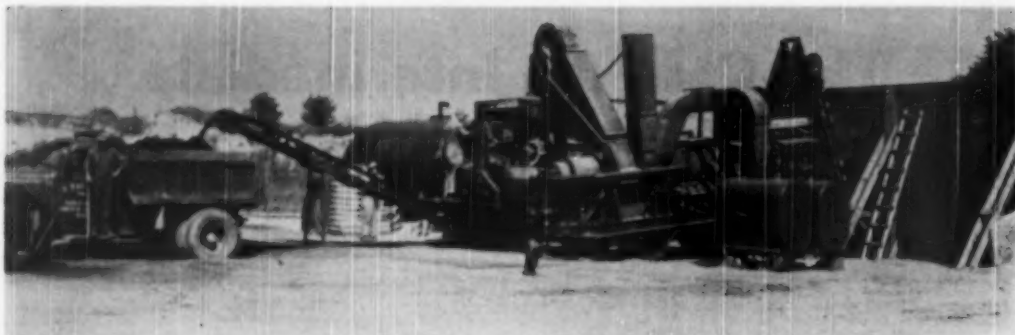
Weather Hazards: Road-mix is at the mercy of the weather. It is possible, and not uncommon for heavy rains to stop the job for prolonged periods, thus greatly increasing the cost per mile, to say nothing of the resulting inferior construction, the time and labor loss for redrying. Every day lost cuts that year's production.

Savings in Bitumen: The use of heavy cutbacks, heavy asphaltic oils, or asphaltic cement employed with hot-mix reduces or eliminates useless solvents required for mixing and spreading road-mix, thus saving on bitumen required. Hot-dry aggregates permit more thorough coating with less bitumen.

Need for Aeration Eliminated: No aeration is required to remove solvent after mixing. This is a costly operation on many road-mix projects. Not only is expensive machine and man time consumed but also con-



★ Mixer and dryer, with portable conveyor feeding the mixer—a quickly movable plant of a type which can handle sufficient "intermediate mix" tonnage for many program needs



★ A maintenance plant which handles all types of mixtures, including hot mix. 10 to 35 tons per hour. Two portable units

siderable solvent is used which in itself can be detrimental in the finished mat. It is never removed entirely. Usually the operator applies a rough "rule of thumb" to determine when enough volatile has been removed to provide stability. This can be a costly guess.

Hauling Water: The mix from the central plant has the moisture removed. For road-mix, the aggregate is hauled in its wet state. For example, 4% of unwanted moisture to remove, in a thousand tons of aggregate per mile, requires the hauling of 40 tons of water per mile for road-mix.

Makes Possible Machine Laying: There are many other advantages in cost reduction and increase in quality, such as central control and protected primed base. The fact that the plant-mix material can be laid with a finishing machine provides a controlled thickness, uniform density, less segregation, straight finished mat edges, a smoother riding surface, and allows traffic to be maintained. This is the greatest single factor that sells

bituminous surfaces to the public.

Pavements laid with a finisher, require less rolling than a mix spread loosely with blades.

With plant-mix and machine laying, no windrows are exposed to weather.

The base may be prepared and primed, so that work can be resumed with a minimum delay after a rain.

Construction can be carried on under traffic, without detours. Higher quality means lower maintenance cost.

Flexibility to Fit the Job: Using the intermediate range is by no means restricting the engineer to one particular type of mix.

On the contrary, he can introduce just as much quality as the job demands, or the budget will allow.

Even if pit-run material is used, even with no attempt at size control, he has gained the advantage of drying and heating, is free to choose a high quality of heavy bitumen.

Aggregate Blending: Often the aggregate is crusher or pit run with a

maximum size particle. This may be used as a single aggregate.

Where the aggregates are available in two sizes, they can be blended at the cold feed with a high degree of accuracy, using a two gate mechanical feeder beneath a divided stockpile and bulkhead arrangement, or with the same feeder mounted under a standard two-compartment bin. A constant aggregate proportioning is maintained with these feeders, and from here on, the material is handled as a composite.

Sand Control

Variation may come from the fluffing factor of wet sand, but in actual practice, when sand is fed from one bin, it has been found that the gate opening can be set to correct for the bulking, which will usually stay the same for many hours.

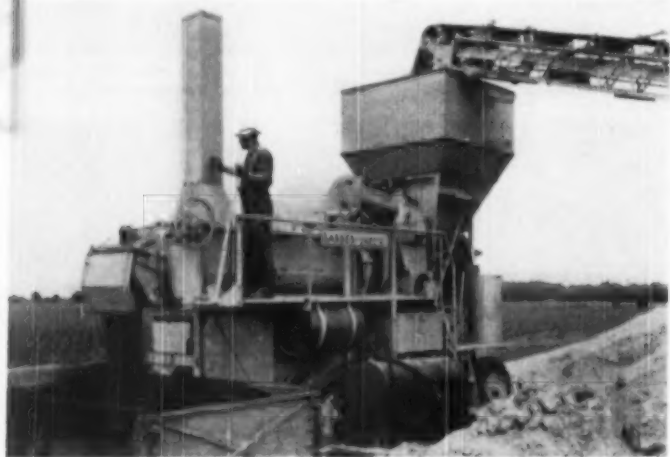
Samples of the dried aggregate give a quick check on the percentage of sand, merely by running a sample over a No. 7 or No. 10 sieve, requiring about ten minutes; indicates the need for adjustment, if required.

Control of the sand fraction is most important for production of a consistent quality of mixture.

Equal in Fines Gradation: No asphalt plant (including the highest type) has any control over the gradation in the fines or sand bin.

Since it is not practical to attempt to screen over an extremely fine screen, the only control of the fine bin gradation is obtained by blending coarse and fine sands at the cold feeders. Thus the dryer-mixer combination has exactly the same accuracy of sand gradation as the highest type multiple-bin plants used for type "I" asphaltic concrete.

Multiple Blending: While the dryer-mixer combination is not a substitute for an "I" type multiple bin plant, it should be pointed out that many users add further quality, by blending several sizes at the cold feed by interlocked feeders.



★ Mixer set up alone here. Usable for central plant operation, fed from pit or stockpile to produce stabilized mix

Chattanooga Runways and Taxiways Surfaced with Asphaltic Concrete

(Supplementary notes on article presented on pages 49 to 53 in this issue)

The stone sub-base and waterbound macadam base described in the above-noted article were topped out with a 1½-in. binder course and a 1-in. surface course of hot-mixed asphaltic concrete. The plant, set up at the crushing plant next to the field, consisted of a 2,000-lb. mixer with steam engine. Capacity: 60 to 75 tons per hour. Asphalt materials were supplied to the plant storage tank by trailers hauling 4,000 gal. per load direct from the Hunt refinery at Tuscaloosa, Ala., 200 miles distant. A Barber-Greene paver was used. Before placing the binder course, the water-bound macadam base was primed with tar.

★ View of completed base and partially completed bituminous surface course on NW-SE runway



★ Aerial view of Lovell Field showing old runways in left background, also beginning of grading on 6200-ft. SSW runway in foreground. Interceptor ditch completely around end



The feasibility of this operation is dependent upon the materials available at the aggregate source.

Mechanically, interlocked multiple blending is simple. Two, three, four or five compartment bins can be used with separately adjustable gate openings, for each size of aggregate. Tunnel conveyors under multiple bins with controlled interlocked feeders are becoming more popular.

Summarizing, the outstanding advantage of bituminous construction is its low cost. It lends itself to stage construction so that the cost and quality of a pavement may be increased only when the traffic requires it. The tests and jobs of many highway engineers show that its use can be greatly enhanced by a more flex-

ible choice of bituminous mixes. Failing to consider intermediate mixes is inevitably failing to produce the highest quality possible with limited funds.

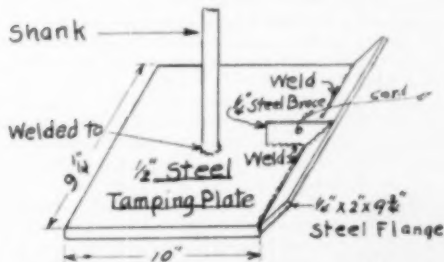
Curb Construction with Bituminous Concrete

CURBS along the highway formed by molding asphaltic mix are more common in some parts of the country than others. In the arid Western states it is common practice to form a rolled curb or a shoulder dike of hot-mixed asphaltic concrete, at the time of placing the surface course. Contractors sometimes have devised special labor-saving forming machines for these curbs, which are specified principally to intercept pavement sur-

face water and channel it to paved run-downs to prevent embankment erosion.

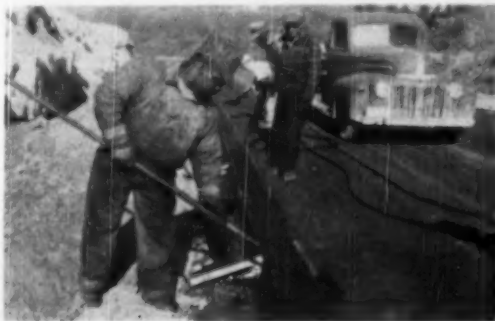
The accompanying photos and sketch show one practical method of forming short sections of curb. Supplied to *ROADS AND STREETS* by A. H. Hinkle, Asphalt Institute, district engineer at Cincinnati, these illustrations are for a curb 3 in. high at the outer edge and 9 in. wide at the base. The sloping surface is a plane, not curved, but any other contour could be created by making the tamping plate conform to the desired cross-section.

The hot-mix for curb construction is delivered in an insulated truck, and a small quantity at a time dumped on a platform dragged by the truck.



★ Details of "homemade" tamping template, designed to be used with a pavement breaker

★ (At right): Setting forms and applying tack coat. Note holding stakes



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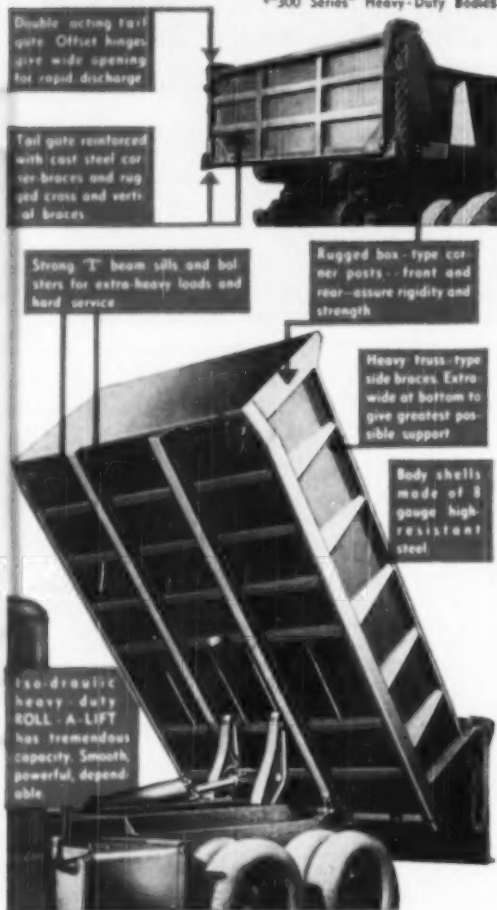
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★ Placing hot-mix and compacting

The first photo shows workers setting forms and applying a tack coat for the curb. The outer form consists of a line of 2" x 4" x 10' boards, set on the edge of the pavement. The inner form is a line of 1/4" x 2" x 10' steel plates tacked temporarily to the pavement with 10-penny nails, designed to serve as a defining straight edge for feathering the curb material down to the pavement.

The second photo shows hot-mix being placed between the forms and compacted into final shape with a steel tamping template (see sketch of template). This template consists of a plate steel shoe, welded to the shank of a pneumatic pavement breaker. The hot-mix is vibrated and smoothed into position as the tamping plate is pulled along.

178 Miles of Sealing Performed in One Contract

ONE of Minnesota's busiest contractors last year was the Jay W. Craig Company, of Minneapolis. This organization completed a sealing contract for the state highway department, totaling 178 miles of highway. Two types of seal were included in two different projects, covering widely scattered work sections in seven of the state highway maintenance districts. The contractor progressed an average of 3.2 miles per 10-hour working day.

One project was 17.8 miles long and comprised 251,000 sq. yd. of heavy type mixed seal, requiring .4 gal. of bituminous material per square yard. The state furnished the bituminous material f.o.b. nearest railroad station, while the contractor furnished mineral aggregates and performed all other items under contract. His bid prices averaged 4 1/4¢ per sq. yd., exclusive of the cost of bituminous material.

The largest project consisted of 141.8 miles in seven districts, with a grand total of 1,947,400 sq. yd. of road surface, on which there was applied an average of .16 gal. per sq. yd., and adequate sand cover material, averaging 14 lb. per sq. yd. Here again the contractor furnished all equipment, labor and materials except the bituminous. Bid price, \$2.85 per sq. yd.

The contractor's bid price for the mixed seal was \$10,650, and for the light seal \$55,727. The total cost to the state, including engineering and overhead, was approximately 10 3/4¢ per sq. yd. for the mixed seal and 4 1/2¢ for the light seal.

The season's work required the use of 16,240 cu. yd. of aggregate, meeting seven different specifications, and 470,000 gal. of bituminous materials.

The aggregates used were produced largely from pits prospected and tested by the contractor. Gradation requirements for most aggregate was as follows:

Passing 1/4 inch	100%
" 1/2 "	95--100%
" 3/4 "	75--90%
" 1 " "	40--50%
" 1 1/2 "	0--20%
" 2 " "	0--5%

This gradation required rejecting sand in order to meet the requirements of the No. 40 sieve. Aggregates were screened and stockpiled from a plant which produced the four aggregate sizes required. The plant consisted of a 4x10 Simplicity screen powered by a Caterpillar diesel engine. Stockpiling and handling into trucks were done with a 3/4-yd. Link-Belt Speeder crane, assisted by an International TD-9 tractor.

Three Distributors

Spreading was accomplished with a 1,250-gal. Roscoe distributor and two Roscoe spray bars mounted on other distributors, the trucks being Fords.

Prior to application of bituminous materials the road surface was swept by a Grace motor-driven sweeper pulled by a Minneapolis Moline model MMRT-1 wheel tractor. Strips of building paper were placed on the road at the beginning of each shot of bituminous material made by the distributor. This procedure eliminated transverse markings in the sealcoat and improved the appearance and smoothness of the final surface.

Bituminous materials were shipped to projects in tank cars and were heated by a Grace rapid-fire circulating heater. They were then hauled direct from the tank cars by F-6 Ford trucks and 1200-gal. semi-trailer distributors. The longest haul experienced on the bituminous material was 25 miles on the section from Bagley to Itasca Park.

A 13-ft. Buckeye sander was used in spreading the aggregates, making it possible to do the average 24-ft. road top in two passes.

All the equipment used on this project was of a highly portable nature, being either self-propelled, as in the case of the screening plant, or hauled on a 10-ton Martin trailer pulled by a WA-20 White dump truck. This White truck was regularly used to haul aggregates along with numerous Chevrolets.

The rolling was performed by a Bros 9-wheel pneumatic-tired roller pulled by a Minneapolis-Moline wheel tractor. Final rolling was done by a 5 to 8 ton Huber tandem steel roller.

During the progress of the jobs the roads had to be kept open for traffic, and cone-shaped rubber markers were used in addition to flagmen to guide traffic and to keep vehicles off the freshly sealed surfaces.

Charles W. Gravis was superintendent for Jay W. Craig Company.

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Bituminous Flexible Pavements

Design Considerations and Construction Practice in Wisconsin

A. T. Bleck

Construction Engineer
State Highway Commission of Wisconsin,
Madison

SINCE the condition of a pavement foundation is dependent upon the constituent soil and its moisture content, the evaluation of a foundation for a pavement depends not only upon the reaction of the soil with moisture but also upon the potential quantity of moisture that will have access to the soil. The former can be ascertained quite readily by means of one or another of the tests devised for the purpose. The latter, however, can be evaluated only quite generally, because of the number and variability of the elements contributory thereto.

The amount of moisture in the underground reservoirs, including the pore space within the soils, is determined largely by the precipitation in the area. Precipitation during the

warmer seasons of the year, except as it may cause pumping in rigid pavements lying on soils whose natural moisture holding capacity was already previously satisfied, is not as immediately critical as that occurring during the late fall and winter. In either case, however, it is not the quantity of precipitation alone but rather the rate and the manner of its dissipation that is the critical factor. Heavy downpours, or heavy snowfall disappearing rapidly and causing floods, help to swell the streams and records but contribute but little to the underground storage, except to the extent that the general ground water table may be raised due to higher elevations of the water in the surface storage reservoirs.

On the other hand, precipitation continuing at a low rate, or heavy accumulations of snow which disappear without appreciable surface runoff, will generate volumes of moisture in the soils which can develop potential detrimental reactions within

them when used as foundations for pavements.

Potential Moisture a Factor

Since foundations for pavements lie in the surficial zones of the soils, wherein external forces contributing to the movement of moisture are active, consideration must be extended to the potential presence of moisture within these zones rather than to an immediate presence or absence thereof at a given time.

The aspects of surface drainage, deep ditches, topographic conformation, and similar features are not always significant in the determinations of the potential of the presence of moisture in the foundation soils.

This is more contingent on the characteristics of the stratification of the soils column, the relative position of their strata toward each other and to the grade line, the presence and location of aquifers, of strata of low permeability, and of the characteristics and position of the bed rock conformations.

A more or less prevalent theory holds that a force termed "capillarity" is responsible for the movement of moisture in the soils, and it is perhaps this concept which more than any other single feature has prevented an understanding of the problems inherent to pavement foundations.

Presented at an Asphalt Conference held by the Asphalt Institute at St. Louis in 1949.

Wisconsin no longer requires a specified base compaction. The so-called capillary theory is disregarded in base design. Soils engineers and road designers elsewhere will find this author's thinking applicable

It has been almost universally noted that pavements lying on soils of so-called high capillary properties seldom if ever exhibited any distress in the summer time, even though there was a manifest high water table. Let us note for a moment the following elements:

1. Information obtained and observations made on the position of moisture in varying strata of soils,
2. The presence of moisture at the interface between base courses and dense graded bituminous surfaces in the fall of the year,
3. The location and position of ice crystal formations in the soils,
4. The occurrence in spring of saturated conditions in dense graded aggregate base courses, initially compacted to high densities even though they were supported by lift or ballast courses of porous material,
5. The correlation of the severity of spring breakup conditions to the meteorological conditions of the preceding winter.
6. And the observed performance of several pavements whose base courses were supported by natural sand subgrades or sand lift courses, the upper six inches of which had been stabilized with soil fines. These factors were instrumental in causing the complete discard of the capillary theory and the search for an explanation of these phenomena which was more compatible with the observed performance.

Moisture Movement

The work of Stephen Taber in connection with the freezing of moisture in the soils, as reported in the *Journal of Geology*, *Bulletins of the Geological Society of America*, and other publications, together with the work on "Thermodynamics of Soil Moisture" by Edlefsen and Anderson, ("Hilgardia" Feb., 1943), and other studies along comparable lines, formed the basis upon which the phenomena of moisture movements in the soils can be explained and the presence of moisture as observed accounted for.

The concept is held that the position of moisture in, or its movement through, the soils, is controlled by a series or group of forces. These forces

are the surface energy of the individual soil particles, the force of gravity, hydrostatic pressure, and the thermal forces induced by the flow of heat through the soils.

Each soil particle is surrounded by an absorptive field of force acting in manner comparable to the force of gravity of the earth, its magnitude varying in some inverse ratio with the distance from the center of the particle. This is termed the surface energy of the soil particle. This force attracts and holds moisture in the form of films against the particles. Due to the inverse ratio of its magnitude the moisture in contact with the particle is held under extreme pressure, which diminishes through the film to the degree that at its outer rim the moisture is loosely held and such portion is quite readily removable. Similarly, the pressure per unit of area on the surface of a small particle is much greater than that on a unit of area on a large particle, which accounts for the greater moisture holding capacities of fine grained soils, and the greater ease with which coarser materials can be dried.

Pendular moisture held by surface tension between the films on adjacent particles spans the pore spaces between the particles.

When this surface energy and the pendular moisture requirements are satisfied, a condition of equilibrium is conceived to prevail, and under conditions permitting of unimpeded internal drainage a soil will not hold more than these quantities of moisture against the force of gravity. This quantity on the basis of tests is at or near the so-called optimum.

Unsatisfied Surface Energy

When the soil has lost some of this moisture, as through dehydration due to hot weather and drouth conditions or as in experiments with dried soils, a condition of unsatisfied surface energy exists, which will want to become satisfied from any source of moisture which may be available, and the movement caused under such conditions is probably an explanation of the so-called capillary rise. However, since a soil cannot hold more moisture than necessary to satisfy its surface

energy against the force of gravity, it cannot cause more than such amounts to rise against this force, and these amounts are insufficient to cause detrimental reactions in the soils under load.

Similarly, when the surface energy is satisfied, additional moisture seeking entrance into it from surface sources must compete for space with the moisture already present, and the rate of percolation or penetration of such additional moisture into the soil is dependent on the hydrostatic pressure which can be built up to force its further movement.

The other forces causing moisture movements in the soils are the thermal forces, or forces induced by temperature differentials causing conduction currents of heat to flow through the soils. During periods of hot weather the flow of heat is from the surface into the earth, causing a condition of dehydration to a greater or lesser extent in the surficial zones of the soils, not so much from evaporation but rather by a stimulation of the downward movement following the conduction current of heat.

Effect of Radiation

Conversely, when the atmospheric temperatures are lower than those of the earth, radiation takes place at the surface, causing conduction currents of heat to rise through the soils. These currents coming in contact with moisture in the soils will carry with them portions of this moisture in a vapor or molecular state. The quantity conducted depends upon the quantity available and the degree and duration of the temperature differentials.

Upon coming in contact with an impervious surface such as a pavement, this moisture cannot escape into the atmosphere, but will accumulate in the material underlying such impervious structure.

Moisture whose movement is activated by these forces will accumulate in soils underlying pavements in quantities in excess of their natural moisture holding capacity, thereby weakening the supporting power of these soils in some ratio varying directly with the quantity thus accumulated. If such moisture subsequent-

★ Placing aggregates for sand ballast course



★ Spreading sand ballast course



ly freezes, a further complication is engendered.

In some soils this will be accompanied by the formation of segregated ice lenses or crystals, with consequent lift or heave, or in the more porous soils the expansion due to freezing may be taken up within the interstitial pore space without producing any lift or heave.

Upon thawing, unless the melt water can escape, extreme loss of bearing will occur in some soils, with consequent disastrous effects upon the pavements supported by them.

The principles involving the position of moisture in the soils and its movement through them are governed by the laws of nature; they are conceived to be quite universally applicable, any differences being those of degree only.

On the other hand, the matters of degree, and the potential of the presence of moisture in the soil to come under the influence of these forces, are purely features of local environment, and hence can be ascertained only by a knowledge attained through the investigation and study of the local conditions, and as a corollary to this, the design of pavements must be made to comprehend these local conditions.

Wisconsin's Problems

The conditions prevailing in Wisconsin are conceived to be severe. There are annually long periods when the atmospheric temperatures are lower than those of the earth. Deep freezing is another phenomenon of annual occurrence. While the annual precipitation is not impressive in volume, much of it finds its way into the subsurface storage reservoirs, particularly when there are heavy accumulations of snow which disappear without appreciable surface runoff.

The general topographic position and geological conformations are conducive to the storage of copious quantities of moisture in these reservoirs.

Geologically the area now forming Wisconsin is of very ancient origin and had been subject to weathering and erosion while much of the contiguous territory was still submerged in the seas. About three-fourths of its area, however, had been overridden

and the surface reworked by the several successive glacial invasions of more recent geological times. The other fourth was an island in the seas of ice and is known as the Driftless Area. Several thousand square miles of this area, however, were inundated by a now extinct glacial lake formed by the effluent from the melting ice of the stagnating ice sheets. During glacial and postglacial times violent storms deposited wind-borne soils in many areas in both the glaciated and non-glaciated regions of the state.

The original residual soils from these rocks were modified through glacial action, some were merely reworked, with the incorporation of glacial debris within them, others were covered by material carried by glacial effluent, sometimes only to be again reburied by subsequent glacial disturbance. This created an oftentimes unpredictable stratification in the soils. Water-borne deposits carried by glacial streams and deposited on land or in lakes often have good sorting but may more often than not be highly stratified with alternating layers of various degrees of coarseness of particles. This sorting and deposition into strata was occasioned not only by the type of material available but also through the quantity and velocity of the carrying medium. Wind-borne materials are apt to show comparable stratification, though this may be quite insensible. Postglacial colluvial deposits have been found to possess distinct stratification.

It has been found through observation in numerous excavations in stratified deposits that the layers of fine material will retain moisture in preference to the underlying coarser material.

In other cases strata of coarse material may be aquifers carrying water under a head. Again certain bedrock formations, notably the lower lying members of the Cambrian sandstones and shales, may be aquifers, as may also be the contact planes between two bedrock formations of different characteristics. There are other combinations and circumstances conducive to a high moisture potential in the soils, but these have been mentioned to serve as illustrations of what can be expected.

The effect upon the moisture potential of the subgrade soils depends upon the proximity of these features to the grade line.

Other sources of moisture which may yield deleterious reactions in the soils are from accumulations of snow upon the shoulders, or from the film and pendular moisture held by the soils themselves when moved upward by the forces of heat conduction.

From a rather extensive study of pavement performance in the state we had developed knowledge on the moisture potential of the soils on the basis of their geological aspects, and this together with experience forms the basis of our current design methods.

Soil Maps Helpful

Soil maps prepared on the pedological classification of soils have been found to be extremely helpful, because in the association of soils to their geological aspects and relationships they represent so much investigation already made; and are further useful to check the judgment formed for a particular location with the performance of other pavements in service in the same general area lying on soils of comparable or similar origin, mode of deposition, and development.

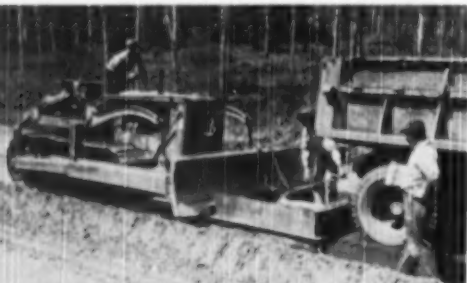
Our problem is primarily one of the control and disposition of moisture in road foundation, but, as previously indicated, the evaluation of the moisture potential can be made in only a rather general manner. We have seen fit to set up five basic classes for design:

1. Natural foundations of sand or gravel inherently not adversely affected by moisture and upon which the base course can be built directly.
2. Materials similar to but requiring a somewhat thicker base because of contamination with minor quantities of soil fines.
- 3, 4 and 5. The other three classes require permeable, freely draining sand or sand-gravel lift or ballast courses extending the full width of the roadway from ditch to ditch. These courses are 9, 12, or 15 in. thick, respectively. The differentiation is made on the evaluation of the moisture potential of the foundation soil on the bases of given geological conditions.

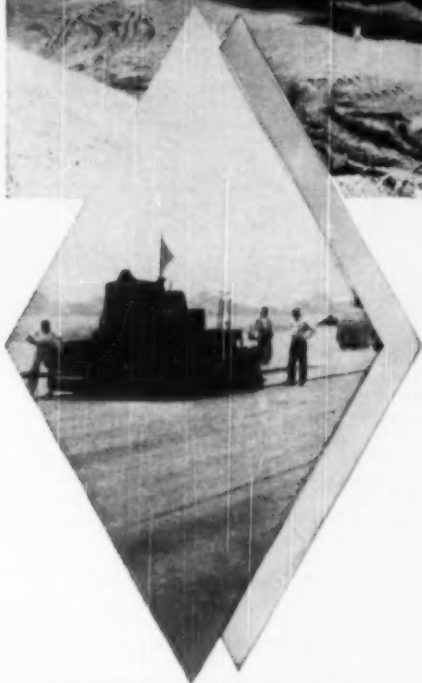
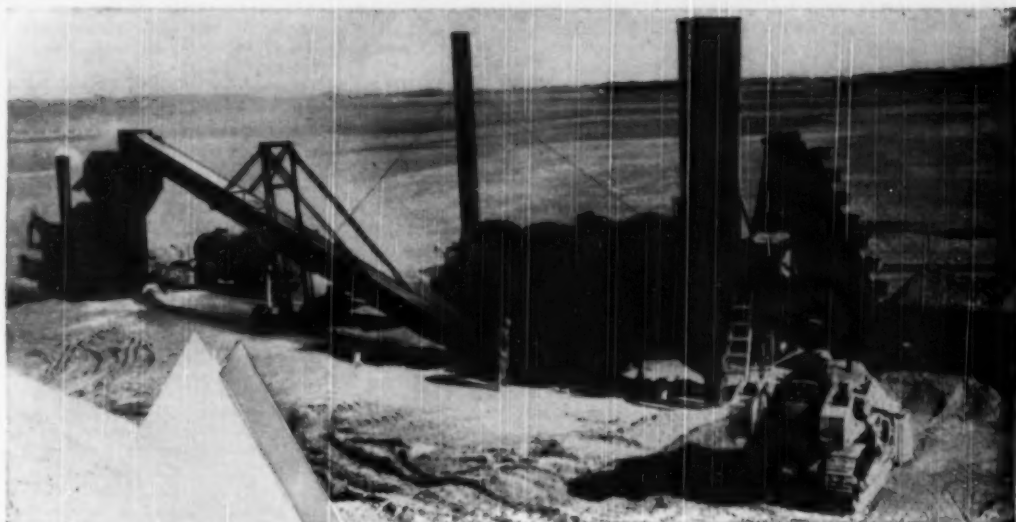
The determination of these thick-

★ Spreading sand-gravel base course

★ Base course completed and ready for prime coat



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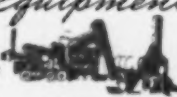
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(Continued from page 76)

nesses is purely empirical, based on previous experience. While the ballast course will aid in the distribution of the load over the foundation, and absorb some of the kinetic energy imparted by moving loads, its primary function is the control and disposition of moisture and the conditions engendered in the foundation soils by it. Being of a porous nature the soils will provide storage space for moisture having entry from surficial sources until it can bleed off laterally or percolate into the underlying soils.

During periods of low temperatures, causing moisture movements from subsurface sources, the rising moisture will enter the ballast course, and incidentally, also the overlying aggregate base course, and it will be stored in these. Should the temperatures become sufficiently low, the moisture in the base and ballast courses will freeze, and by the time the freezing isotherm has descended through the ballast course, very cold weather will generally prevail, causing a rapid freeze in the underlying soils, thereby minimizing or preventing the formation of segregated ice crystals in the immediate subgrade zone, because the time element for moisture movement in quantity will be lacking. Freezing at the lower limit of frost penetration will induce the development of ice crystal formations in that zone, where they can do no particular harm, and because of the high intermolecular attraction between ice and water, further moisture movement to the surface will be inhibited, and the frozen zone between the subgrade and the lower limit of frost penetration will not be apt to contain excessive moisture.

When thawing sets in, the melt water accumulations in the base and ballast courses will be disposed of by lateral percolation. Should there have been any ice crystal formations in the subgrade soils as the melt water from these is formed, it is displaced upward into the ballast course, from whence it can bleed off, thereby inhibiting the extreme loss of bearing power that would otherwise take place. Due to these processes, the stabilization of the upper portions of ballast courses with soil fines is not indicated, as these would merely soften up and act as lubricants between the sand particles, permitting of movement and displacement, with consequent effects upon the pavement supported by it.

While the controlling elements in ballast course design are the potential foundation conditions, the design takes in the element of traffic potential. In this feature also, the design is empirical, based on experience rather than on a computation premised on

assumed wheel loads.

Under Wisconsin conditions the general trend is that commercial traffic, including the heavier trucks, varies but little from an almost constant percentage of the total traffic. Since the frequency of repetition of heavy loads appears to be the critical factor rather than the load within legal limits itself, the differentiation of base course thicknesses has been made on the basis of total traffic volumes.

On highways carrying average daily volumes of 100-500 a 6-in. thickness is required; from 500-1000, 8 in.; from 1000-2000, 10 in.; and over 2000, 12 inches. The base courses are of graded aggregates.

Density Not Specified

We have abandoned the practice of requiring these base courses to be constructed to given specified densities and are satisfied if the base course has sufficient stability to inhibit displacement under load. We believe some porosity in a base desirable.

This conclusion has been attained by springtime examination of a number of base courses compacted to densities ranging between 135 and 145 lb./ft.³ prior to bituminous surfacing.

Upon opening the bituminous surfacing it was found that the base courses had lost all of this density and were quite loose; in several cases the lower portions of the base courses were in a saturated condition, even though the supporting ballast course was only slightly damp. The moisture did not have access through the surface, but rather was carried through the ballast course into the base by the ascending conduction currents of heat, and subsequently froze in the base courses. The expansive force of freezing moisture, being very great and having no pore space into which it could be dissipated, disrupted the dense structure of the base course to provide room for itself. Later in the year, with the reversal of heat flow, moisture is driven out of the base, and under traffic a reconsolidation of the base course will be effected.

While the expansive movement due to freezing need not be considered because of the support given by frozen material, the movement inherent to reconsolidation should be considered in the design of the surface course. In a manner parallel to the differentiation between thicknesses of base course, bituminous surfaces 2, 2½ or 3 in. thick are designated.

In our earlier work these generally were built by road-mix methods, using cut-back asphalts or road oils for binder. At present the trend is toward a greater use of hot-mix asphaltic concrete dense graded type of materials,

with asphalt cement as the binder.

A representative mileage has been built approximately as described, which yielded a background of experience to draw on. Some of this work was done before the war. To date no basic failures have become manifest. Some jobs have had seal coats. On one job the initial surface was built during the war under restrictions on use of bituminous materials. The consequence was a very thin mat with a deficiency of asphaltic binder, which soon ravelled. This required the construction of a new surface.

Parts of the surface of another job had to be reworked, introducing additional asphaltic material, because a deficiency of this material in the original construction caused ravelling.

Some isolated turtleback cracking has been observed on one job. This was traced to an excess of soil binder in the base course, which was built when it was still believed that density was a desirable property in these courses.

We had hoped that some means would present itself whereby mathematical determinations of some of the design features could be made. However, each scheme or method which came to mind appeared to be circumscribed by some indeterminate and indeterminate factor which would necessitate assumptions which might or might not be tenable.

In view of this, it is felt that the only course to pursue is to continue along the line of experience and to gather such additional information as may come to light on the background already established, on which further design refinement can then be predicated.

Correction to Article On Tar Treated Gravel

Those of you who read the article in *MARCH ROADS AND STREETS*, "Practical Questions and Answers on Tar Treated Gravel Roads," may have sensed that there was a printer's error. This is the article by George E. Martin appearing on pages 94-96.

The portion from line 39, first column on page 96 to the end of the article, should have appeared immediately following line 7 on the previous page. In view of the wide applicability of the data contained in this article, it is suggested that you open your March issue of *ROADS AND STREETS* and reread pages 94-96 with this transposition in mind.

Reprints of the corrected article are also available. Address your request to George E. Martin, Consulting Engineer, The Barrett Division, Allied Chemical & Dye Corporation, New York 6, New York; or address Editor, *ROADS AND STREETS*, 22 West Maple Street, Chicago 10, Illinois.



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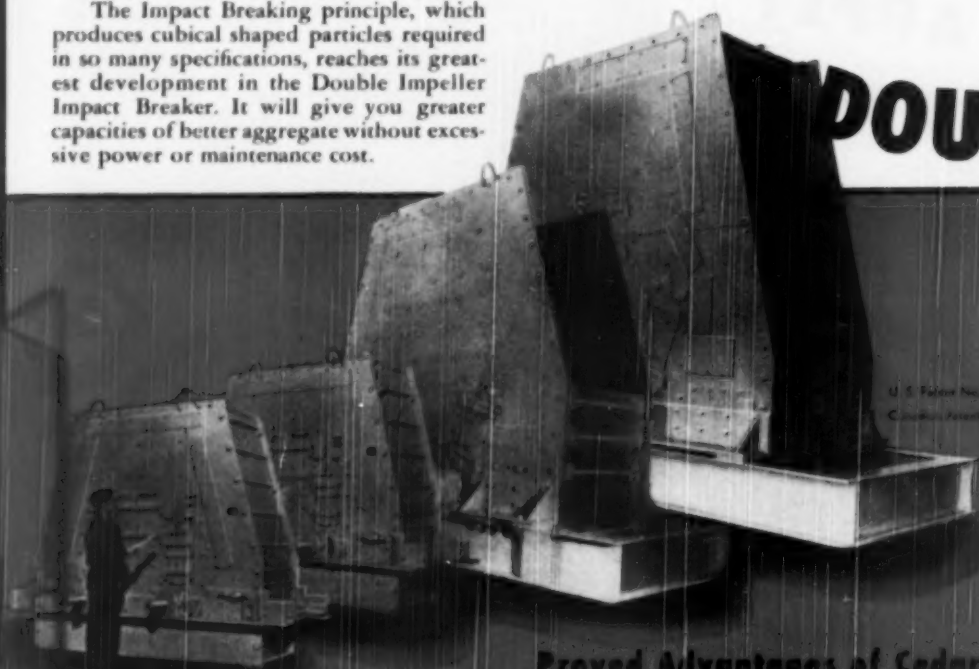
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Proved Advantages of Cedarapids Double Impeller Impact Breaker

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★ **LESS** horsepower required per ton of material

★ to break all sizes because the massive impellers continually balanced, have a flywheel effect and a great percentage of stone is broken in mid-air by some hitting stone resulting in a greater reduction in milling and crushing action.

★ **HIG** volume production. In a domestic installation in Ohio the operator claimed 720 tons per hour using two 150 h.p. motors.

★ **APPROXIMATELY 90%** less contact of stone on metal because a high percentage of the material is broken by impact against other material rather than against the breaker bars. Also screens eliminated to ensure discharge opening free of grates, etc.

★ **HIG** production and high reduction ratio mean lower plant investment.

★ **CAPACE** of 400 tons from Model 1000, which will take 10" rock up to 400 tons per hour and reduce it to 4" minus in one operation. Same as the Model 1020 with its 24" square feed opening.



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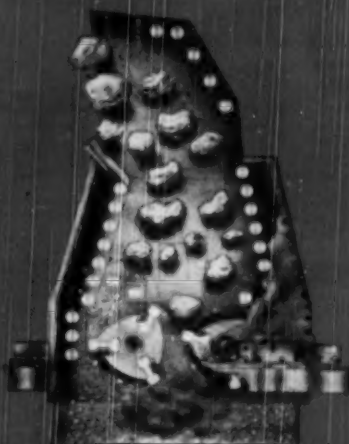
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★ Only two moving parts—the impellers—both easily accessible. Minimum down time for repairs or replacements because of simplicity of design.



Sectional view of Cedarapids Double Impeller Impact Breaker showing simplicity of construction and operation. Material falls directly onto impellers and is hurled against the breaker bars and other material in the breaking chamber.

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★ Only Cedarapids Double Impeller Impact Breakers give you all these features. No imitations can equal their performance. Forward only by patent. Beware of imitations.

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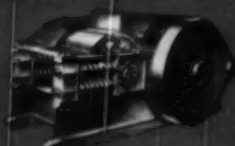
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Soil Stabilized

BASE COURSES WITH TAR

All micaceous soils are ruled out of new specification proposed by ARBA committee

By A. R. Taylor

Koppers Company, Inc., Tar Products Division, Pittsburgh 19, Pa.; and Chairman ARBA Committee on Tar Stabilized Roads

THE original report of the Committee on Tar Stabilized Roads covered the activities of the Committee previous to 1946 and is contained in ARBA Technical Bulletin No. 104. This report was based upon answers to questionnaires which has been circulated by the Committee, and included specifications for tar-soil and tar-sand stabilized base courses.

Following this report, the Committee endeavored to simplify the method used for determining the suitability of soil for stabilization, and submitted a Progress Report covering this study at the ARBA annual meeting in January, 1948. At the Road Show in July,

Presented at the American Road Builders' Association Conference and 17th Annual Meeting, Cincinnati, Ohio, March 6-7-8-9, 1948

TABLE I—Data on South Carolina Tar Stabilization Projects

Project & Location	Clay + silt in M'd. Passing No. 10 Sieve %	Plasticity Index	Est. Mica Content %	Date Constructed	1940	Inspection 1946	1949
Johnsonville-Hemingway	36.51	N.P.-13	—	1935	Good	Excellent	Excellent
Kingsree	22.36	5	—	1935	Good	Excellent	Excellent
Mt. Carmel	50.73	—	Trace	1936	Good	—	Good
Willington	31.68	11-39	Trace-30	1936	Fair	—	Fair
Clemson-Columbia	39.65	15-35	Trace-50	1937	Fair	—	Fair
St. Stephens, Rt. 43	14.39	1-7	—	1937	Good	Excellent	Excellent
Great Falls-Lancaster	23.88	N.P.-25	Trace-70	1937	Many Failures	High Maintenance	Few Failures
Cypress Gardens, Rt. 320	50.68	—	—	1937-38	Good	Bad	Bad
Greenwood-Stade, Rt. 178	38.37	8-17	Trace	1937-38-39	Poor	Poor	Poor
Della House School, Greenville	31.41	—	Trace	1937	Good	—	Good
Orangeburg, Rt. 4	21.41	3-7	Trace	1938	Good	Good	Good
Whitmore-Carlisle	26.38	10-18	20-75	1938	Many Failures	Poor	Poor
Monks Corner-Pinebluffs, Rt. 46	23.39	4-9	—	1938	Some Failures	Fair	Fair
Sharon-Lochhart	26.86	N.P.-31	Trace-30	1938	Many Failures	Poor	Poor
Parkers-Wallhalla, Rt. 183	26.42	5-11	Trace-40	1938	Many Failures	Poor	Poor

TABLE III—Results of Cooperative Tests ARBA Committee on Tar Stabilized Roads Mica Content of Test Samples

Laboratory Reporting	South Carolina Soil		Number I		North Carolina Soils		Number II	
	S. C. Method %	Flotation %	S. C. Method %	Flotation %	S. C. Method %	Flotation %	S. C. Method %	Flotation %
Alabama	22.5	unsatisfactory	10.0	unsatisfactory	33.0	unsatisfactory	—	unsatisfactory
Bartlett	15.9 (24.2)	8.2 (unsatisfactory)	4.1 (2.8)	not run	26.9 (26.9)	unsatisfactory	—	unsatisfactory
C. A. A.	11.0	16.0	1.0	0.8	17.0	9.0	—	9.0
Koppers	23.0	unsatisfactory	5.0	unsatisfactory	26.0	unsatisfactory	—	unsatisfactory
Minnesota	not run	unsatisfactory	19.0 (unsatisfactory)	unsatisfactory	not run	unsatisfactory	—	unsatisfactory
Missouri	8.4 (18.7)	unsatisfactory	6.4 (12.1)	unsatisfactory	15.3 (18.9)	unsatisfactory	—	unsatisfactory
N. Carolina	11.3 (23.8)	not run	5.0 (15.1)	not run	9.7 (34.0)	not run	—	not run
Ohio	32.1	unsatisfactory	not run	not run	not run	not run	—	not run
P. R. A.	unsatisfactory	9.3*	unsatisfactory	11.8**	unsatisfactory	20.7*	—	20.7*
S. Carolina	11.4	not run	6.9	not run	14.2	not run	—	not run

*P. R. A.'s results were obtained using a modified flotation method.

**Not a micaceous material.

The figures in parentheses represent the average of the estimated mica contents in the various fractions tested which is the South Carolina Method for calculating the total mica content of the samples.

TABLE II—Results of Cooperative Tests ARBA Committee on Tar Stabilized Roads Soil Constants and Percent of Silt + Clay in Test Samples

Laboratory Reporting	South Carolina Soils			North Carolina Soils					
	P.I.	L.L.	% Silt plus Clay*	Number I	L.L.	% Silt plus Clay*	Number II	L.L.	% Silt plus Clay*
C. A. A.	16.9	43.8	25.0**	14.0	80.1	57.0**	7.4	60.2	70.0**
Koppers	14.6	43.3	41.0	15.9	47.4	54.0	N.P.	53.0	47.0
Missouri	15.7	42.9	41.8	15.6	51.3	57.7	10.3	54.5	48.3
North Carolina	14.0	44.0	39.0	19.0	54.0	55.0	4.0	57.0	48.0
South Carolina	—	—	41.0	—	—	63.0	—	—	60.0

*Considered as material passing the No. 200 sieve in the minus No. 10 portion

**Taken from gradation curve.

1948, W. C. Ricketts, member of the Committee, summarized the activities of the Committee up to that time and outlined the construction of tar-sand stabilized base courses constructed by the Corps of Engineers. This report may be found in ARBA Technical Bulletin No. 148.

Since 1948, the Committee has attempted to find a suitable method of test for the determination of the mica content of a soil. Previous work done by the Committee in reviewing the characteristics of soils used in tar-soil stabilized base construction in South Carolina and other states, with regard to the surface qualities of the projects, indicated that the soils used in the more successful projects had three characteristics: (1) a plasticity index of 15 or less, (2) a silt plus clay content not greater than 50% (based on the material passing the number 200 sieve in the minus number 10 portion of the soil), and (3) a mica content of 5% or less.

Table I summarizes these data on the soils stabilized in South Carolina for which the most complete information was available. It was the opinion of the Committee that the use of these soil characteristics as limiting values would eliminate the doubtful soils from stabilization with tar. Since there was a need for a simple, rapid procedure that indicated the suitability of a soil for tar stabilization, especially if counties and small towns were to attempt such work, it was felt that these limiting values might be set up as requirements to determine suitability of soils which could be successfully stabilized.

The tests made to determine the amount of material passing the No. 200 sieve and the plasticity index are relatively simple and are well-known. It remained, therefore, for the Committee to investigate the possibility of setting up a rapid and simple test for the determination of mica content.

The State of South Carolina, for a number of years, used a simple method which gave the approximate amount of mica in a soil, and it was from the results of this method, which had been used on the soils stabilized in South

Carolina, that the limiting figure of 5% mica had been established. This method consists of separating the mica from the soil particles by placing

weighed portions of the soil fractions remaining from the hydrometer test for mechanical analysis on a piece of coarse-textured paper and tilting the paper so that the bulkier grains roll off first, leaving the mica behind. In addition to the above method, there are several others that may be used for separating materials of different specific gravities.

One of these, the flotation method suggested by the U.S. Bureau of Public Roads, consists of placing the materials to be separated in a heavy liquid, the specific gravity of which has to be adjusted so that separation is obtained. It was decided that this

(Continued on page 86)

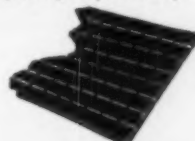
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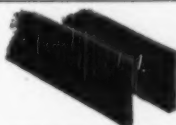
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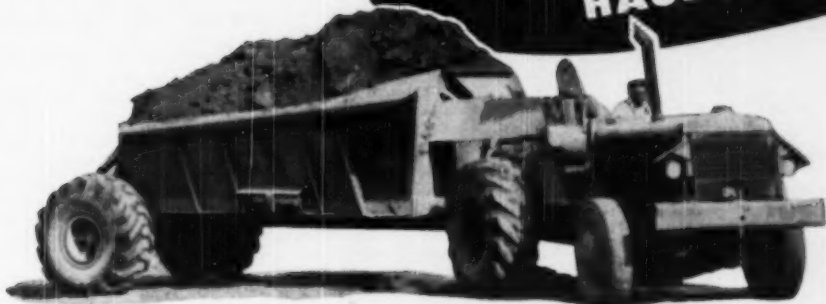


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(Continued from page 83)

method, using bromoform, be investigated by the Committee along with the S. Carolina method.

At the last meeting of the Committee on Tar Stabilized Roads nine laboratories, with another entering later, agreed to cooperate in the testing of micaceous soils which would be supplied by Committee members Messrs. Fahnestock and Mills. Accordingly, micaceous soils, two from N. Carolina, and one from S. Carolina, were sent to the various laboratories to be tested with respect to the requirements set up by the Committee. The results of the tests for silt plus clay content and plasticity index were fairly uniform except in the case of the second N. Carolina soil, which contained considerably more mica than the others. Results of the test for mica content, however, showed a wide variation for both methods of test. The results of the tests performed on the soils are shown, Tables II and III.

Most of the laboratories indicated a preference for the South Carolina method over the flotation method, although it was known to be inaccurate. In most cases the separation by flotation was unsuccessful because the specific gravity of the mica overlapped the specific gravities of the other materials present in the soils. Several of the laboratories stated that they did not feel that either method was suitable; and one, the Public Roads Administration, after finding that neither was suitable, modified the flotation method so that separation of the mica was obtained. It was found that treatment with hydrochloric acid before the soil was placed in the bromoform would essentially rid the soil of the materials whose specific gravities were overlapped by that of the mica. This method, however, requires considerable time and technique and is not likely to be performed by many small organizations interested in tar-soil stabilization. The wide variation in the results obtained with these two methods of

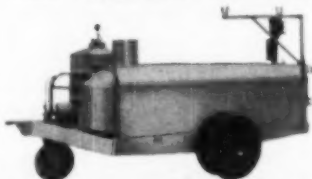
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test for determining the mica content of a soil definitely indicates that at this time neither of the tests is suitable for inclusion in a soil stabilization specification.

Consideration was also given to the advisability of including requirements for the liquid limit and plasticity index which would indicate whether a soil contains an appreciable amount of mica, since micaceous soils generally have high liquid limit and low plasticity index values. However, a study of the S. Carolina soil data showed that this method was not reliable in many instances but did indicate that soils having high liquid limit and low plasticity index values should be further investigated.

As a result of the study, the Committee decided to revise the requirements contained in the Specification in Bulletin No. 104 for determining the suitability of a soil for stabilization with tar, in order that organizations with limited technical personnel and laboratory facilities could utilize certain soils for tar stabilization with reasonable assurance of success.

The Committee decided to specify that any soil which contained more than a trace of mica, by either visual or microscopic examination, be excluded from stabilization with tar. While this requirement may eliminate some soils from stabilization, nevertheless, it will also have a tendency to eliminate many failures that might otherwise occur if stabilization is attempted by organizations not thoroughly versed in this type of construction. This does not mean that soils not meeting the three requirements cannot be stabilized provided sufficient granular admixture is added so that the requirements are met or the suitability of the soil has been established by extensive laboratory tests, other than those necessary to determine the three specified requirements.

With these factors in mind, the Committee has revised Paragraph 2.01, which read as follows:

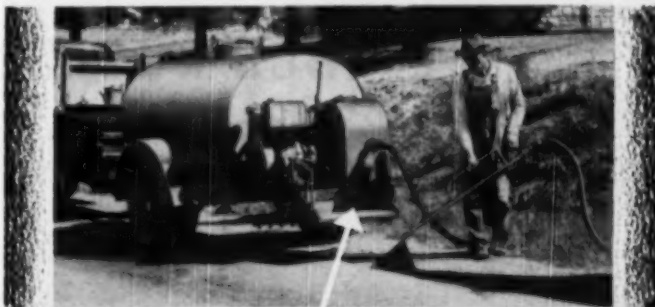
"2.01 Soil groups (BPR classification) A-1, A-2, A-4 and A-5 having low capillarity and plasticity values are satisfactory for stabilization. Soil group, A-5, having high capillarity and plasticity values, and soil group A-6 and A-7 shall have sufficient granular admixture to raise the classification of the soil to that

of group A-4 or better. Stabilization should not be attempted with micaceous or higher organic soils."

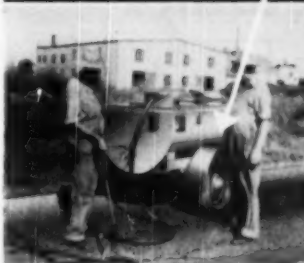
★ 4. Harrowing and mixing.

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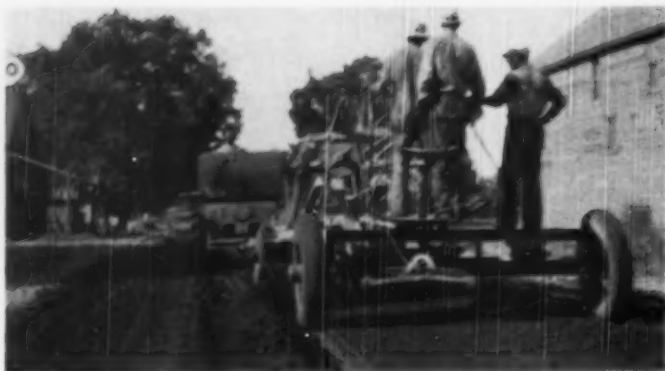
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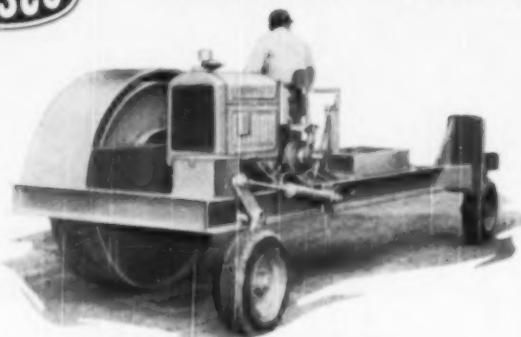
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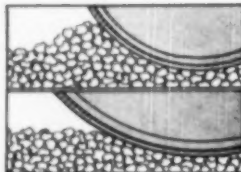
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★ 5. Compacting with sheep's-foot roller

★ 6. Compacting and leveling surface

or microscopic examination shows no more than a trace of mica, (2) the silt plus clay content (Material passing the No. 200 sieve in the minus No. 10 portion) is not greater than 50%, (3) the plasticity index value is not greater than 15. Soils not meeting these requirements shall not be stabilized unless sufficient granular admixture has been added so that these requirements are met, or the suitability of the soil for stabilization has been established by previous experience, or by more extensive laboratory tests than those necessary to determine the above three requirements.

In addition to Paragraph 2.01, the Committee deemed it advisable to revise Paragraph 4.02, Preparation of Roadbed, which made no mention of the depth to which granular admixture should be mixed with an inferior soil. Obviously, if inferior soil is used, either the depth of the stabilization should be increased or the quality of the subgrade improved. With this in mind, the Committee has revised Paragraph 4.02, and added Paragraphs 4.03, 4.04 and 4.05.

The revision is as follows:

4.02 Preparation of Roadbed. The existing roadbed shall be graded and shaped to conform with the plans or as directed by the engineer. Any additional soil required shall be placed, and any unsuitable material removed and replaced with acceptable material as directed by the engineer. Suitable subdrains shall be installed to maintain a low water table, when so directed by the engineer.

4.03 When granular admixture is required to improve the soil in the roadbed for the tar stabilized base courses, the remaining unimproved soil in the subgrade will have lower bearing capacity than that of the improved soil. To compensate for the lower bearing capacity of the unimproved soil in the subgrade, the depth of the tar stabilized base course shall be increased from two to four inches; or else the upper four to six inches of the subgrade material shall be improved by the addition of granular admixture. The granular admixture for either purpose shall be placed and mixed as directed by the engineer in such quantity and manner as to produce after mixing an improved soil conforming with the requirements specified in Paragraph 2.01.

4.04 When the improved soil for the tar stabilized base course exceeds ten inches in depth, the tar stabilized base course shall be constructed in two or more layers, as directed by the engineer.

4.05 When the subgrade material is to be improved, the improved soil for the tar stabilized base course shall be removed from the road

surface and placed in windrows along the edges of the road. Granular admixture shall then be added to the soil in the subgrade, which shall be thoroughly mixed and compacted without the addition of tar. After compaction, the improved soil for the tar stabilized base course, previously placed along the edges of the road, shall be bladed onto the prepared subgrade.

The above revision emphasized the necessity of either increasing the depth of the stabilization, or improving the upper part of the subgrade when an inferior soil is encountered. This introduced a new factor, making it necessary to include items in Paragraph VI to cover the cost of such additional work. For this reason, the Committee revised Par. 6.00 under Basis of Payment to read as follows: 6.00 This work shall be paid for at the contract unit price per square yard for Tar-Soil Stabilized Base Course complete in place and accepted. Any increase in depth of the Tar-Soil Stabilized Base Course authorized by the engineer shall be paid for at the unit price per square yard per inch of additional depth. Such price and payment shall be full compensation for all equipment, tools, labor and incidentals necessary to complete all work described under the specifications, excluding the water and tar, the application of same, the quantity of additional soil or granular admixture, and the processing and compacting of the subgrade to specified depth, which shall be paid for under their respective items.

and added the following Par. 6.04:

6.04 The processing and compacting of the subgrade when required shall be paid for at the contract unit price per square yard for admixing the granular material and compacting the subgrade.

With the above changes in the specification for Tar-Soil Stabilized Base Course, the Committee hopes to make soil stabilization available to small organizations and improve the quality of the work done by more closely controlling the types of soil permitted for tar stabilization. The three requirements for determining the suitability of soil should eliminate the more questionable soils and give reasonable assurance that the soils meeting these requirements will provide satisfactory bases when stabilized with tar. This is necessary if stabilized bases are to be used to any extent by organizations not thoroughly versed in soil stabilization.

The Committee recognizes the fact that the requirements contained in Par. 2.01 for determining the suitability of soil for stabilization will eliminate some soils that can be stabilized satisfactorily. This is justified as the soil requirements eliminate the use of unsuitable soils which may result in partial or complete failure and tend to retard the developments of soil stabilization. Stabilization of the more questionable soils should be attempted only by organizations having adequate laboratory facilities and trained personnel. However, in such cases, the chance for successful stabilization will be considerably less than when the

soil requirements are met.

The revised specification for Tar-Soil Stabilized Base Course is contained in an Appendix A, together with the specification for Tar-Sand Stabilized Base Course. The Committee hopes that the revised specification for Tar-Soil Stabilized Base Course will result in a wider use of this type of construction and enable organizations not equipped with extensive laboratory facilities or trained personnel to utilize this type of construction when standard types of aggregate, such as gravel, slag or stone are not available at economical cost.

Employees Safety Record

During 1949 "no accident" reports were chalked up for 1,368 equipment operators employed by the Pennsylvania Department of Highways. These employees included drivers of snow plows, cinder trucks and general maintenance equipment.

Of this total 184 have rolled up 10 years or more of perfect driving. Twelve have driven 15 years without an accident; five, 20 years; six, 21 years; one, 22 years; two, 23 years, and one, 24 years. One driver has the department's topmost record: 28 years without an accident.

TRENCHING IS NO PROBLEM..

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UNIT 614 Trencher digging trench for oil field pipe line.

Digs trenches for pipe... sewer and water connections... Footings... Basements... Culverts... and a thousand other excavating jobs.

Trims corners, neatly and squarely... cuts a level floor... delivers straight vertical side walls without additional labor of hand trimming.

Powerful... compact... perfectly balanced... every UNIT is designed to meet the most rigid demands.

Trouble-free, economical performance built into every machine... Service and maintenance needs are negligible.

Write for literature.

1/2 and 3/4 Yard EXCAVATORS

CRANES up to 15 TONS

Convertible to ALL Attachments



UNIT 357 Mobile Trencher. Self-propelled... rides on rubber... goes anywhere... digs deep. Convertible.

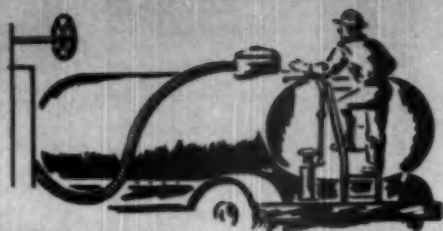
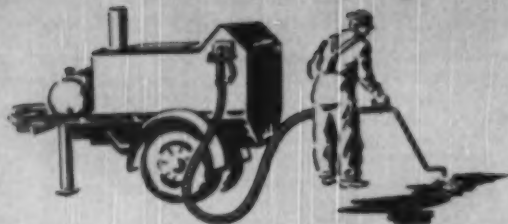
UNIT CRANE AND SHOVEL CORP.

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A 5427-1/2 ICA

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KETTLES



... for TANK CAR
UNLOADERS

DEFIES HOSE KILLERS! ABRASION! HEAT! FLEXING!

PENFLEX FLEXIBLE METALLIC HOSE KEEPS TAR MOVING—COSTS DOWN!

Penflex is a ruggedly built, interlocked metal hose with all the flexibility required, plus the toughness and durability of steel. No matter how hot the tar, or asphalt, Penflex cannot be "cooked" like ordinary hose. It stubbornly defies rough abuse, abrasion, flexing, and crushing.

No wonder that from coast to coast, road builders and maintenance departments are finding that Penflex

Tar and Asphalt Hose keeps operating costs down.

There is a Penflex hose for every type of surfacing equipment—for tar and asphalt spraying trucks—for tar and asphalt kettles—for tank car unloaders.

You can't afford not to specify Penflex... the hose that defies abrasion, heat, flexing and crushing. Investigate today Penflex's advantages by writing for descriptive bulletin #91.

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NEW EQUIPMENT AND MATERIALS

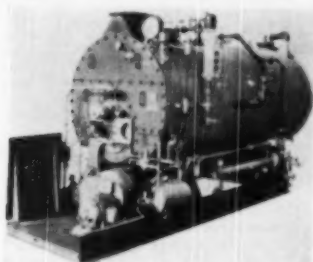
New and Improved Construction Products

Additional facts on products described below can be obtained from the manufacturer via postcard inserted at page 96. Each item is numbered. Just circle the corresponding number on the card and mail.

1

Boiler Uses Low Cost Fuels

A new model added to the line of self-contained 15 to 800 hp boilers of the Cleaver-Brooks Co., Milwaukee, Wis., is designed to make more effective use of low-cost fuels, heavy oils and gas. Included among the model's features is a rotary burner, simple, compact and fully automatic, which is claimed to provide unprecedented flexibility in burning



Model LR Boiler

heavy oils or industrial gases. A single, low-speed, low-power consumption blower furnishes all the air for combustion. This results in less weight and reduction in sound levels. A totally enclosed, drip- and dust-proof panel protects all major electrical controls. Electronic combustion safety devices and dual low-water cutoffs are standard equipment. The simplified design of a combination gas-oil burner permits rapid changeover from oil to gas or the reverse in less than a minute.

2

Greasing Outfits

Two models of a portable "one man—one hand operated greasing outfit" have been announced by the Alemite Division of Stewart-Warner Corporation, Chicago, Ill.

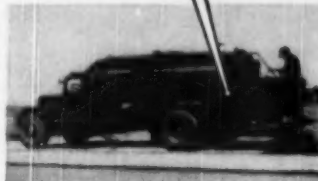
Model 7185-A, called the "Dyn-O-Luber," is equipped with a "Dyn-O-Mite" gun which weighs but 2 lb. and greases up to 55 bearings. Model 7185-B, the "Dyn-O-Pistol," comes with a gun with nine-ounce capacity. Two elements comprise this new greasing outfit—a loading pump and a grease gun. The loading pump is mounted in a rigid steel cover which fits the top of any standard 25 or 35 lb. size original lubricant bucket or pail, replacing the original container cover. Three sturdy hook bolts hold the pump in a positive dirt-tight seal on the container. With a few strokes of the pump handle the gun is filled with lubricant through a loader valve on the pump and a loader fitting on the gun. The gun is then uncoupled and is ready for use.

This Pump is a BIG FEATURE of KINNEY DISTRIBUTORS

The Kinney SD Rotating Plunger Pump brings these 6 big advantages to all Kinney Bituminous Distributors—

1. **ACCURACY:** The SD pump is accurate as in meter.
2. **SIMPLICITY:** No valves, springs or gaskets—all passages clear and unrestricted.
3. **JACKETED CONSTRUCTION:** Pump heated by engine exhaust for quick, easy starting.
4. **LARGE CAPACITY:** Up to 405 G.P.M. driven by oversize 39 H.P. Hercules engine.
5. **DEPENDABILITY:** Built for rugged service and long life with minimum maintenance.
6. **ACCESSIBILITY:** All parts readily accessible for adjustment or repair.

Throughout the world, highway departments and private contractors for forty years have relied on Kinney Distributors for applying oils, tars, asphalts and emulsions. Write for Bulletin A-49; it tells the whole story of Kinney Distributors.



KINNEY MANUFACTURING CO.

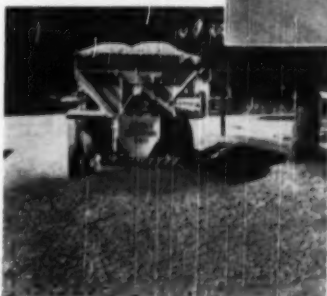
3517 Washington Street, Boston 30, Mass.

New York • Chicago • Cleveland
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We also manufacture liquid pumps and vacuum pumps.

BLACK TOP SURFACING MADE EASY

With HI-WAY Model "R" in action—at right.



HIGHWAY Model "E" Spreader—Spreads small rocks, chips and gravel for surfacing and shoulder maintenance. Used to stop bleeding on black top.

Designed for dust control with calcium chloride in summer or for spreading sand and cinders in winter. Covers full width of 2 or 4-lane highway in one operation. Operates forward or reverse; all controls within easy reach of driver's seat.

Available: 9', 12', 15', 18'-lengths
mounts on any truck chassis.

HI-WAY Model "R" Spreader—Stores time, labor and material. Fast, accurate operation. Spreads chips, rock, gravel smoothly—on thick or thin spots. Ideal for seal coats on oil.

Operates forward or reverse simply by shifting lever. Adjustable feed gate controls thickness of spread; width is adjustable from 1 foot to full width of the spreader. Entire unit balanced for quick, easy hook up to truck.

Available: 8', 9', 10', 12', 15', 18'-widths.
Four pneumatic traction tires: 8', 9', 10'-widths.
Six pneumatic traction tires: 12', 15', 18'-widths.

Contractors and Municipalities
Write to us today about your
surfacing and spreading problems

Manufacturers of the World's
most complete line of Spreader

HIGHWAY EQUIPMENT COMPANY, INC.

405 D Avenue, N. W.

Cedar Rapids, Iowa

Additional facts on products described below can be obtained from the manufacturer via postcard inserted at page 96. Each item is numbered. Just circle the corresponding number on the card and mail.

3

Water Sprinkler Tanks

A new line of water sprinkler tanks, announced by Littleford Bros., Inc., 453 E. Pearl St., Cincinnati 2, O., are designed primarily for soil stabilization, dust control, water hauling and weed control. The tanks are made in two models, gravity type and pressure type. Both



Littleford Water Sprinkler

models can be skid mounted, truck mounted or 4-wheel trailer mounted in any capacity from 800 to 1,500 gal. Made sturdy and rigidly supported, these sprinklers will stand the roughest use. Large manhole makes them easy to fill, and the spray bars are designed so they are easy to remove. Spray bar can be made with shifting and und folding features.

4

Variable Weight Rollers

A new line of variable weight 3-wheel rollers, equipped with ballast-type rolls, has been announced by the Buffalo-Springfield Roller Co., Springfield, O. Three rolls are constructed with heavy steel rims, welded to steel head plates and form with the hub a watertight compartment. Filling and drain plugs are installed in the outer heads to facilitate



New Buffalo-Springfield Variable Weight Roller.

ballasting. On models where wet sand ballast is recommended, a shovel opening with bolted watertight cover is also provided in the outer head. One variable weight unit is stated to cover a weight range equal to three fixed capacity models.

5

33 cfm Compressor

A new compressor announced by P. K. Lindsay Co., Everett, Mass., is claimed to be particularly suited for such work as curb and sidewalk alterations and repairs, traffic control installations, and street repair work. It has a capacity to run a paving breaker in the 30 to 40 lb. range and a 30 lb. rock drill. The compressor has a displacement of 50 cfm and delivers 33 cfm at maximum recommended speed. Working pressure is ad-

justable to 100 lbs. Multiple air chambers give adequate cooling and eliminate pulsations, and automatic unloading ensures economy. A 2-cylinder gasoline engine develops 11 hp at normal speed and provides ample smooth power. An adjustable speed governor enables the operator to vary the capacity to the work being done.

6

Diesel-Powered Generator Units

Production of a standard commercial line of Cummins diesel-powered electric generator units has been announced by Cummins Engine Co., Inc., Columbus, Ind. Sixty-cycle units are available in 40, 50, 60, 75, 100, 125, 200 and 250 kilowatt ratings. Similar units are also available for 50-cycle operation at a slight de-rating in KW capacity. Optional equipment offered by Cummins for the various generator units includes automatic overspeed shut-down control; automatic high temperature and low lubri-



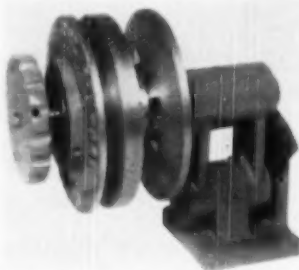
Diesel-Powered Generator Unit Model NHSGA

cating oil pressure shut-down; complete marine-type or radiator-type cooling systems; hydraulic governor; water-cooled exhaust manifold, and generator mounted package control unit. Special generator voltages and KW ratings are also available. The standard diesel generator units as offered by Cummins Engine Company, Inc., are of the alternating current type, 50-60 cycle, 3-phase 3-wire, 3-phase 4-wire.

7

Variable Speed Transmissions

New variable speed transmissions for fractional horsepower motors, announced by Frazier & Son, Belleville, N.J., feature an automatic speed locking device which keeps the pulley in the desired position throughout the entire 3-to-1 ratio and in a control against speed slippage. Rate of speed can be easily changed and set by a simple knob movement. Constant selected speeds are stated to be assured.



Standard Model "Pro-Sure" Transmission

8

3 Engine Choice for Bottom Dump Hauler

For bottom-dump hauling, R. G. Le-Tourneau, Inc., Peoria, Ill. is now offering the model E-16 Tournahopper powered by the C Roadster Tournapull prime mover available with a choice of three engines—GM-6-71, Cummins HRB-600 or the Buda 6-DC-844. The Tournahopper has a heaped capacity of 16 tons or 15 cu. yds. Its 9 ft. 2 in. by 9 ft. 2 in. bowl presents an easy target for shovel or dragline to hit and fill.



Model E-16 Tournahopper with C Roadster Tournapull

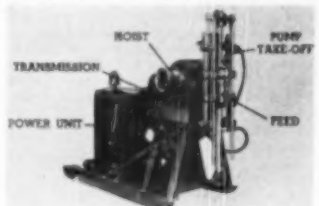
Its bottom-dump doors operate in a manner similar to a clamshell, swinging upward along the outside of the Tournahopper bowl as they open. Positive electric control of the self-cleaning doors permits controlled ejection by opening the doors to any desired width. Where controlled ejection is unnecessary, the doors can be opened to full width, thus making possible extremely fast ejection. Clearance with the bowl doors opened is 22 in.; with bowl doors closed, 19 1/2 in.

The 90° left and right turning angle gives the rig a minimum turning radius of 14 feet. Speeds range from 3.37 in first gear to 34.61 mph in fifth gear.

9

Core Drill

A new core drill, announced by Acker Drill Co., Inc., Scranton, Pa., is designed to provide a light, compact, portable drill of medium capacity for depths to 600 ft. Basically, the drill consists of a simple combination of a three speed, totally enclosed transmission with either a hydraulic feed or a screw feed drill head. The hydraulic feed gives the apparatus



"Toredo" Core Drill

sensitive and instantaneous control of the rate of advance and the pressure on the bit, permitting the drill to be advanced as fast as possible in changing rock strata and also providing the uniformity of pressure necessary for the highest recovery of quality corals. On the other hand, the screw feed drill is somewhat lighter in weight and lower in cost. Power can be supplied by whatever type of power plant best meets the customer's operating and mounting requirements.

10

1/2 Yd. Tractor Shovel

A new tractor shovel with 1/2 yd. bucket capacity has been added to the Payloader line of The Frank G. Hough Co., 871 Sunnyside Ave., Libertyville, Ill. Like other Payloaders, this model HE is a complete Hough-built tractor-

JAEGER paver-type AGGREGATE SPREADER

the low-cost, accurate, self-propelled spreader you've been looking for



ALL TRACTION ON SUBGRADE or compacted course. No displacing of loose material. 4-wheel drive.



STRAIGHTEDGE RUNNERS carry screed independent of rest of machine, average out subgrade irregularity, insure accurate lay.



LAYS MANY MATERIALS: The Jaeger is adaptable for free-flowing bituminous mixes as well as all aggregates up to 4" stone.



UP TO 25' IN TANDEM: Use 2 low-cost spreaders to lay and roll full-width base. Keep your costlier paver busy on top course.



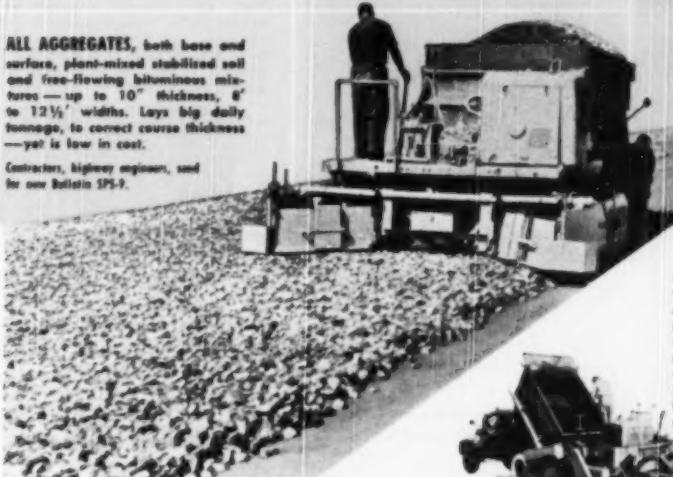
BLENDS PERFECT JOINTS: Side control gates furnish material for blender wings to form joint. Saves hand work.



QUICK WIDTH CHANGES, 10' to 12 1/2' by simply cranking telescopic shaft, adding screed inserts. Block off for 8' to 10' widths.

ALL AGGREGATES, both base and surface, plant-mixed stabilized soil and free-flowing bituminous mixes—up to 10" thickness, 8' to 12 1/2' widths. Lays big daily tonnage, to correct course thickness—yet is low in cost.

Contractors, highway engineers, send for our Bulletin SP-9.



JAEGER BITUMINOUS PAVEN "Teams" with the Jaeger Aggregate Spreader: America's most advanced precision paver for all types of bituminous material. Oscillating tiltable screeds, almost instant width adjustability up to 12 1/2', positive automatic leveling. Paves flush to curbs, gutters. All traction and heavy load confined to subgrade. Ask for Catalog BP-9.

CONCRETE PAVING CONTRACTORS: Get labor-saving mass-production with Jaeger Diagonal-Screed Finisher and Screw Spreader "Team". Ask for catalog.



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Distributors in 130 Cities of the U.S. and Canada

JAEGER
engineered equipment

PUMPS • AIR COMPRESSORS • MIXERS

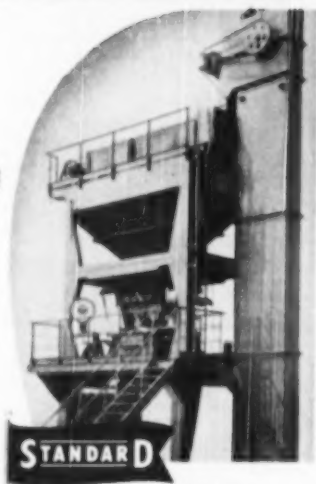
CONTRACTORS FAVORITE



EMBURY LITTLE AIR PILOT LANTERN

- Sturdy Compact Design
- Automatic Standing Bail
- Windproofed Flame
- Easy to Light
- Burns 30 Hours on one Filling

ORDER FROM YOUR DISTRIBUTOR
Embury AIR PILOT lantern with
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MONEY-SAVING PAVING PLANTS

The most rugged plants in America
and the cheapest to own and operate.
Less maintenance. Simplest
design. Seven sizes. Unit built.
Prompt delivery.

Write for catalog.

STANDARD STEEL CORPORATION

3003 Boyce Ave., Los Angeles 38, Calif.

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with-shovel, expressly designed for tractor shovel work. It has a full-reversing transmission with four forward and four



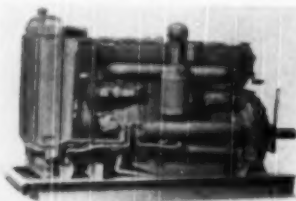
Model HE Payloader

faster reverse speeds coupled with forward-reverse control separate from the regular gear shift.

11

Murphy Diesel Offers More Models

The Murphy Diesel Co., 8317 W. Burnham St., Milwaukee 14, Wis., has announced certain refinements in design which are claimed to provide more power, greater economy, greater dependability and longer life. At the same time the number of models has been increased. Five 4-cylinder models and six 6-cylinder



Murphy Diesel

models ranging in output from 90 to 200 h.p. are now available. The Murphy principles of "true" diesel operation, plain open combustion chamber, four valves per cylinder, hydraulic servo-type governor, etc., remain as the basis of the design of the engines, the additional power output resulting from improvements in the application of these principles.

12

Pile Puller

A new pile puller for extracting wood piles, poles, and posts, announced by Downs Crane & Hoist Co., Los Angeles, Calif., adjusts itself to any size or shape piling. The inner surface of the puller consists of a series of heavy knife edges



Downs Pile Puller

ASPHALT PLANTS

PORTABLE AND
STATIONARY

High Production—
Low Cost



THE McCARTER IRON WORKS, INC.
NORRISTOWN, PENNA.

for biting into the pile transversely to the grain of wood, providing a positive hold for pulling pilings that are hard to grip due to creosote coating, marine growth, grease or odd shape. The pile puller maintains its grip throughout the pulling and stacking operation, yet is easy to remove from the pile. It can be set in place on a pile by hand or with the assistance of a pile line. Large handles aid workmen in setting the pile puller in place. Large smooth eyes are easy on wire rope slings.

13

Three-Footed Tamper for Backfills

It is generally recognized that existing backfill methods and procedures can be improved greatly. The Gunderson-Taylor Mch. Co. of Denver, Colorado, has come forward with a tool that greatly increases efficiency, and output per man-hour, of backfill operations. It is called the Triplex Backfill Tamper. It is claimed this air-operated unit will do more work than



Triplex Backfill Tamper in Use on Colorado Big Thompson Project

three individually operated single standard type backfill tampers and do it better in less than half the time required by three single units. In fact, a bulldozer is required to keep up with the tool. It is one man operated and will not exceed 105 cu. ft. of air per minute at 100 lb. per sq. in. pressure, even up to 8000 ft. elevation. It is being successfully used on several large dam projects in the West.

14

Mobile Radio Transmitter-Receiver

A new 10-watt mobile radio transmitter-receiver, announced by General Electric, Electronics Park, Syracuse, N.Y., is designed for adjacent channel

operation in urban and metropolitan areas. Designed to improve performance in the crowded radio frequency spectrum at the lowest possible price, the single unit consists of a 10-watt transmitter, receiver and power supply in one cabinet. Features include triple-tuned transformers for extra high selectivity, peak audio output of 2 watts, adjustable IF gain control, and built-in low pass harmonic filter that reduces interference to other services, including television. The new unit weighs 32 lbs.

15

Truck Mixers

New Loadlimit models have been added to the line of truck mixers of The T.L. Smith Co., Milwaukee, Wis. These new machines are said to haul full rated truck mixer payloads and still meet the high-way load limitations imposed by most



New Loadlimit Truck Mixer

states. Reduced weight is accomplished through the elimination of parts and assemblies which are not basic or necessary to mixer operation. Available in 2, 3, 4½ and 5½ yd. sizes, with higher ratings for agitators.

16

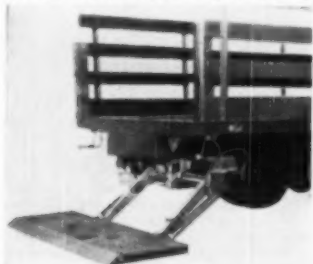
6 In. to 14 In. Suction Hose

A new extremely flexible and light-weight suction and discharge hose specifically designed to handle dried leaves in leaf collecting machines, street refuse in street cleaning machines, hay, ensilage and other comparable materials has been announced by The B. F. Goodrich Co., Akron, O. The hose is suitable for full vacuum and any discharge pressures where the material is to be conveyed by a moving air stream. The hose is one-ply, wire reinforced, with a smooth bore, and is manufactured in lengths up to 15 ft. in from 6 to 14 in. inside diameters.

17

Hydraulic Elevator Tailgate

A new hydraulic elevator tailgate added to the line of hydraulic hoists and bodies of Marion Metal Products Co., Marion, O., is engineered to provide a powerful hydraulically controlled elevator as well as a safe, locking tailgate at the rear of delivery trucks. All lifting, closing and lowering is hydraulic—op-



Marion Hydrogate

erated by a single lever. The Hydrogate lowers within a few inches from the ground, or stops and holds at any height desired, as well as locking at truck-bed level. A Marion safety feature prevents the tailgate "freight elevator" from dropping accidentally from the truck bed level. The Hydrogate has a rated lifting capacity of 2000 lbs.

18

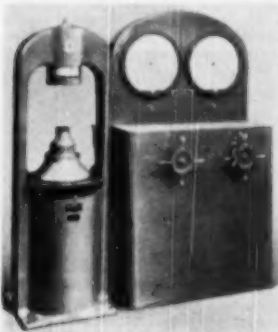
Welding Gloves

Three new styles of welding gloves have been added to the line of Air Reduction Sales Co., 60 E. 42nd St., New York, N.Y. The new gloves are labeled, "A", "B", and "C". The "A" gloves, most costly of the three, are made of soft, rugged carpincho leather with a wool-lined back for maximum heat resistance. The "B" gloves are a gauntlet type in the medium price range and offer the same construction features as the "A". The "C", most economical of the three, offers construction features similar to "B" but has a two-piece lined leather gauntlet.

19

Two-Unit Concrete Tester

Principal features of a new concrete and cement testing machine of 300,000 lb. capacity, announced by The Baldwin Locomotive Works, Philadelphia, Pa., is that loading and weighing units are separate. This prevents the transmission of load shocks to the indicators. The two-unit



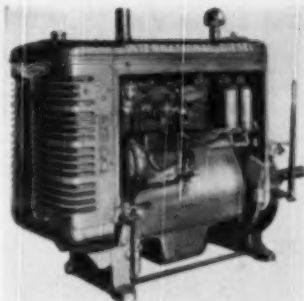
Two-Unit Concrete Testing Machine

design also permits varying their relative positions to suit conditions of use and protects the operator from flying or falling particles of breaking specimens. The new testing machine is a hydraulic compression-type especially suitable for standard concrete cylindrical test specimens 3 in. by 6 in., 6 in. by 12 in., and 8 in. by 16 in.

20

Diesel Engines

Increased horsepower, improved performance diesel power units and automotive engines of the 4-cylinder International "9" series, are now available in the new UD-9A models, announced by International Harvester Co., Chicago, Ill. Engineering design changes which accomplish greater power output, smoother operation and longer service life of parts, have been made in both the UD-9A automotive engine for motor graders and other self-propelled machines and the UD-9A power unit for a wide variety of stationary installations in many industries. New features of the basic "9" engine include: redesigned pre-combustion chamber and piston; the "A" series I.H. fuel injection pump; simplified injection nozzles; counterbalanced crankshaft and new connect-



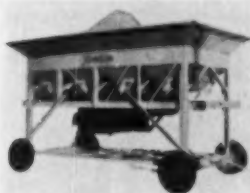
Complete UD-9A Power Unit

ing rods. The improvements establish a higher compression ratio, 15.7 to 1 compared to the former 14.4 to 1, and greater burning efficiency with corresponding increase in working horsepower per unit of fuel consumed. As a power unit equipped with air cleaner, radiator, fan and clutch, the UD-9A delivers 62.5 h.p. at 1600 r.p.m. under intermittent load. This compares with 53 h.p. at 1500 for the previous model. The UD-9A automotive engine operates at governed 1800 r.p.m., delivering 70 h.p. at that speed.

21

Mobility Added to Batcher

Adding pneumatic tired wheels and two-bar assembly to the Lo-Bin trolley batcher is the latest advancement in its batching equipment announced by the C. S. Johnson Co., Champaign, Ill., a subsidiary of Koehring Co., Milwaukee, Wis. The resulting improved portability



Lo-Bin Trolley Batcher Mounted on Wheels

for the trolley batcher reduces time losses for between job moves and eliminates the need for dismantling the batcher when changing job locations. The Johnson Lo-Bin trolley batcher is designed with a maximum bin capacity of 30 tons and with an exceptionally low charging height of only 9½ ft. With flared extension panels removed, the bin measures 7½ ft. in height and holds 8 tons.

22

Portable Road Beacon

A portable road beacon designed for use in highway construction has been developed by Standard Telefon-og Kabel-fabrik, Oslo, Norway, a manufacturing associate of International Telephone and Telegraph Corporation, 67 Broad St., New York 4, N.Y. The beacon is 22 in. in height, is 8 in. in diameter and weighs only 29 lbs. It utilizes a battery of four 1.5 volt dry cells which, under normal operating conditions, will give six months of service. A lens drum of pressed glass protects the lamp and provides increased light in the horizontal direction.

Additional facts on products described below can be obtained from the manufacturer via postcard inserted at this page. Each item is numbered. Just circle the corresponding number on the card and mail.

23

Truck Loader

A loader unit that can be mounted on standard dump trucks and when not in use does not interfere with the use of the



Holmes-Owen Loader Bucket Remains in This Position When Not in Use

truck for any other purpose, has been placed on the market by Ernest Holmes Co., Chattanooga, Tenn. The loader is double-jointed in design to give each movement the flexibility of elbow action. It is powered by two independently operated sets of hydraulic cylinders. The loader in no way obstructs dumping operation. When truck is in position for dumping, the driver in the cab simply raises the shovel arms and bucket to provide sufficient clearance for unloading the dump body.

24

Vibrating Test Sieve Shaker

A new, vibrating, test sieve shaker for laboratory screen analysis work, developed by Syntrol Co., 384 Lexington, Homer City, Pa., is small in size, easily



Syntrol Test Sieve Shaker

portable and quiet in operation and operates on common 110 volt A.C. convenience power outlets. The vibrating action of the shaker is produced by the Syntrol patented electromagnet drive energized by rectified, half-wave A.C. current—2600 vibrations per minute from 60 cycle. There are no bearings, gears, belts or pulleys, etc. to maintain and replace—no lubrication required.

25

General Purpose Power Roller

The line of low cost power rollers of Gabb Manufacturing Division of E. Horton and Son, East Hartford, Conn., has been supplemented by Series AR which incorporates a heavy duty combination reverse gear and forward clutch assembly designed for constant operation in either forward or reverse. This assembly



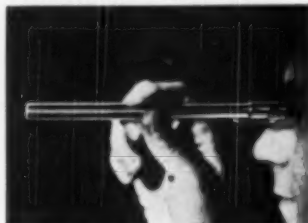
Motoroller Tandem Model (Series AR)

will operate at the same speeds in either forward or reverse. The "Motoroller" is a low cost versatile general purpose power roller claimed to be especially adaptable to the requirements of landscapers, contractors, municipalities, schools, colleges and country clubs. It is of the water ballast type. A unique feature which contributes to the versatility of the Motoroller is that with one draw pin the machine can be converted from a riding type tandem model to a compact walk-behind model in a matter of seconds.

26

Pocket Telescope Weighs 2 oz.

A 6-power telescope that clips in his pocket like a fountain pen announced by Fun-technics, Ltd., Encinitas, Calif., is stated to have been extremely valuable in checking grade stakes, elevation sizes and centerline marker flags. The instrument



Funscope Pocket Telescope

is 5 in. long and weighs 2 ounces. It offers full 6-power magnification and a field of view of 315 ft. at 1000 yards. Tests are stated to have proved it equal in performance to fine prism binoculars.

27

Front End Loader

A new front end loader, Trojan Loader, placed on the market by Contractors Machinery Co., Inc., Batavia, N.Y., is designed as a utility power pack for year 'round multi-job application. It has a general utility $\frac{3}{4}$ yd. bucket and can be equipped with a loose material 1 yd.



Trojan Loader

bucket or a $1\frac{1}{4}$ yd. snow bucket. In addition it can be equipped with such Trojan

engineered attachments as crane hook, fork, dozer blade or snow. The Loader is powered by a I.H.C. "4" series engine developing 40 hp. at 1450 rpm.

28

Generator for Tractor-Drive

A new type of generator designed for belt-drive and producing regular high-line type electricity has been added to the line of D. W. Onan & Sons, Inc., Minneapolis, Minn. Available in 3,000-, 5,000- and 10,000-watt capacities, the new "Tractor-Drive" generators supply exactly the same 115/230-volt, 60-cycle alternating current delivered by the commercial power lines. A feature of this new type generator is



Tractor-Drive Generator

the mounted control box, with convenient knockout plugs, containing an A. C. voltmeter which permits the generator speed to be adjusted to correct voltage, and a protective circuit breaker to guard against overloads.

29

4-Ton Truck

A 4-ton truck has been added to the line of "Job-Rated" trucks of the Dodge Division, Chrysler Corporation, Detroit, Mich. This new and more powerful truck is being introduced in 30 basic models. Designated as the Y and YA models, the new trucks have a nominal rating of four tons, a gross combination weight of 50,000 lbs., and a gross vehicle weight 28,000 lbs.—an increase of 5,000 lbs. over the 23,000-



New Dodge 4-Ton Truck

pound maximum GVW formerly offered by Dodge. A completely new engine that develops 330 pound-feet gross torque was specially designed for the new 4-tonner. The 6-cylinder engine delivers 154 gross horsepower, has a compression ratio of 6.5 to 1, and a displacement of 377 cu. in. Important new engine features that insure high power output with low cost operation include twin carburetors, twin manifolds, a twin exhaust system, and hydraulic valve lifters. Body and payload allowance runs up to 19,800 lb. The trucks are built with wheelbases of 130, 142, 154, 172 and 180 in.

30

24½ Cu. Yd. Scraper

A completely new 24½ cu. yd. heaped (19.2 cu. yd. struck) Model 625 4-wheel cable operated scraper has been built by the Findlay Division of Gar Woods Industries, Inc., Findlay, O. This new open bowl scraper was designed for use with the Allis-Chalmers HD-19 tractor. Posi-



Model 625 Scraper

tive forced ejection is accomplished by a sliding end gate which moves forward to positively eject all material in the bowl. The ejector or sliding end gate is returned to the digging position by heavy duty springs. The cutting edge is bowed and of three piece construction. To assure maximum economy the end sections and center section are reversible. Side cutting edges are bolted to the scraper for ease of service. Proper pitch of the cutting edge and the correct bowl and apron proportions are stated to enable the Model 625 to load easily with a live boiling action. A heavy duty 8 in. ball in socket (shimmed for wear) is provided in the fifth wheel to maintain the strength required at this point and to give the flexibility needed.

31

Safety Valve for Air Lines

A safety valve produced by Danielson Safety Valves, Inc., Richmond, Calif., has

only one moving part—a steel ball within an oddly-shaped chamber, working automatically both ways under air and gas pressures up to 15,000 lb. to the square inch. An advantage claimed for the valve is that it instantly shuts off air or gas pressure at the source of supply when a



Closeup of Danielson Safety Valve, Showing Ease of Installation

line break occurs or a tool is removed, and it automatically releases the flow as soon as a line break has been repaired or a tool changed. It is stated that with a Danielson safety valve in the manifold outlet, workmen can safely change pneumatic tools on the line right on the job, thus doing away with the need of going back to the supply source to a shutoff valve. Pneumatic tool damage, caused by water in lines removing tool lubricants, is claimed to be greatly reduced when a Danielson safety valve is on the line. Air passing into the line through the bleeder port, while the workmen prepare to connect or disconnect tools, quickly forces out the grit and moisture. The more water and abrasive substances in the line, the faster is the action.

32

Self Priming Pumps

Four new 1½ in. and 2 in. self priming engine driven portable pumps with capacities up to 7,000 gal. per hour and weighing as little as 56 lb., have been announced by the Ohler Machinery Co., Waterloo, Ia. They are powered by the 1½ hp. and the new 2½ hp. model 8FB Briggs and Stratton engines. An exclusive "Twin Prime" method of priming is said to eliminate priming valves and (Continued on page 100)

Quick Help on Product Information

1. For latest information on any product you need in road-building, earth moving, heavy construction, etc., check items on this page, fill out coupon, clip page, and mail. If convenient, use typewriter or print. Or attach to your business letterhead. Give particular type, model, capacity, or other specific data on the blank line below. The blank line can also be used for naming items not listed. Address **ROADS AND STREETS**, Reader Service Department, 22 West Maple Street, Chicago 10, Illinois.

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Check products below on which you wish us to obtain information for you:

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- ☐ 1 Bins and Hoppers
- ☐ 2 Conveyors
- ☐ 3 Crushers
- ☐ 4 Portable Plants
- ☐ 5 Screens

II BITUMINOUS:

- ☐ 6 Batchers
- ☐ 7 Finishers
- ☐ 8 Distributors
- ☐ 9 Dryers
- ☐ 10 Heaters
- ☐ 11 Plants (central)
- ☐ 12 Plants (travel)

III CONCRETE:

- ☐ 13 Batchers
- ☐ 14 Buggies and Carts
- ☐ 15 Finishers
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- ☐ 19 Pavers
- ☐ 20 Reinforcing Steel
- ☐ 21 Road Forms (1000' set)
- ☐ 22 Tower
- ☐ 23 Truck Mixers

IV CRANES:

- ☐ 24 Crawler Mounted
- ☐ 25 Truck Mounted
- ☐ 26 Piledrivers

V GRADERS:

- ☐ 27 Blade, self propelled
- ☐ 28 Blade, pull type
- ☐ 29 Blade, under truck
- ☐ 30 Elevating

VI LOADERS AND TRENCHERS:

- ☐ 31 Front-end loader (tractor mounted)
- ☐ 32 Loader, bucket type and belt type
- ☐ 33 Trencher or Ditcher

VII HAULING EQUIPMENT:

- ☐ 34 Dump Truck
- ☐ 35 Other Trucks
- ☐ 36 Dump Wagons, tractor drawn
- ☐ 37 Flatbed Trailers

VIII PUMPS:

- ☐ 38 Centrifugal
- ☐ 39 Diaphragm
- ☐ 40 Piston

IX POWER UNIT:

- (Independent)
- ☐ 41 Gasoline
- ☐ 42 Diesel
- ☐ 43 Electric

X ROLLERS:

- ☐ 44 Power (Smooth)
- ☐ 45 Pneumatic Tire
- ☐ 46 Sheepfoot

XI TRACTORS:

- ☐ 47 Crawler
- ☐ 48 Rubber Tired

XII TRACTOR EQUIPMENT:

- ☐ 49 Bulldozers
- ☐ 50 Power Control Units
- ☐ 51 Rippers
- ☐ 52 Scrapers, tractor drawn
- ☐ 53 Scrapers, self-powered

XIII BUCKETS:

- ☐ 54 Clamshell
- ☐ 55 Concrete
- ☐ 56 Dragline
- ☐ 57 Orange Peel

XIV SHOVELS AND DRAGLINE:

- ☐ 58 Crawler (under 1 yd.)
- ☐ 59 Crawler (1 yd. up)
- ☐ 60 Truck Mounted

XV ROCK DRILLS, AIR TOOLS:

- ☐ 61 Air Compressors
- ☐ 62 Backfill Tampers
- ☐ 63 Clay Diggers
- ☐ 64 Concrete Vibrators
- ☐ 65 Drills, cable tool
- ☐ 66 Drills, tripod and wagon
- ☐ 67 Drills, rock, hand-held
- ☐ 68 Paint Sprayers
- ☐ 69 Paving Breakers
- ☐ 70 Riveters and Chippers

XVI MISCELLANEOUS:

- ☐ 71 Buildings, portable
- ☐ 72 Earth Drills, power
- ☐ 73 Light Plants
- ☐ 74 Lubrication, Service
- ☐ 75 Mowers, Highway
- ☐ 76 Power Saws
- ☐ 77 Soil Stabilizing Equipment
- ☐ 78 Spreaders, sand
- ☐ 79 Street Flushers
- ☐ 80 Street Sweepers
- ☐ 81 Welders
- ☐ 82 Cutting Torches
- ☐ 83 Hydraulic Jacks
- ☐ 84 Hydraulic Control Equipment
- ☐ 85 Hand Tools
- ☐ 86 Hoists, derrick type
- ☐ 87 Highway Guard
- ☐ 88 Snowplows, rotary
- ☐ 89 Snowplows, v or wing
- ☐ 228 Salt

Use This Coupon

Other products not named above, or specific variety of the products checked

Title or Profession _____

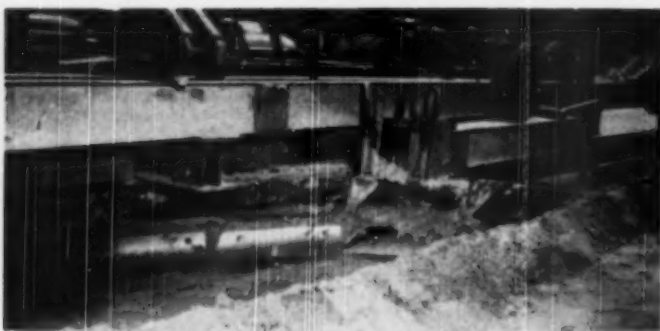
Your name _____

Name of your company or governmental dept. _____

Type of work for which equipment will be used _____

Street Address _____

City _____ State _____ County _____



★ More detailed glimpses of the special trench linegrader. Note the front end construction (left), and the middle or under-reaming blade and rear clean-up blade (right)

★ Trench prepared and U-bar dowels in place, ready for concreting

(Continued from page 64)

working against traffic, the crew then working back through the job on the opposite side, also by Special Equipment Company.

Next came a special machine, which shaved the trench bottom to the elevation slightly above the final cross-section height, and under-reamed the slab for the concrete sill required. This machine, known as a "true grader" and rented from its inventor consists of a long-wheel-base propelling unit, mounted on large off-road-type tires, which traveled along the pavement lane next to the widening work. Mounted on this machine's chassis is a liftable side frame from which is suspended the trenching unit. This unit comprises a front plow blade, set at an angle to throw material outward from the slab edge; an extension on the front plow for further moving spoil outward; and a second and third diagonal blade for under-reaming and finishing.

The second blade is a 6 in. high unit which does the under cutting. The third or rear blade throws out the under-cutting spoil and gives the sub-

grade its final truing.

The outer rear corner of the trenching unit rides on steel road forms which are thrown into position, section by section and quickly staked and leveled as the machine progresses. In addition to a flanged steel wheel riding the forms, a rubber tired wheel traveling on the finished subgrade also helps support the unit in the rear.

The blade unit is further controlled by front and rear casters which ride the exposed slab edge, it being the operator's responsibility to so guide the machine that these casters hug the old slab at all times in case the lateral blade throw doesn't provide sufficient side thrust to keep the casters in contact.

The subgrade was then tamped lightly with hand tampers, and the specified reinforcing set. This consisted of a line of 1/4-in. round U-bars so positioned as to provide transverse bars extending into the sill at 18 in. spacing. Bars were supported on ordinary steel chairs.

The subgrade was inspected for soil and drainage conditions, and when necessary minor replacement of unsatisfactory material made, but the subgrade was found to consist largely of an excellent selected soil.

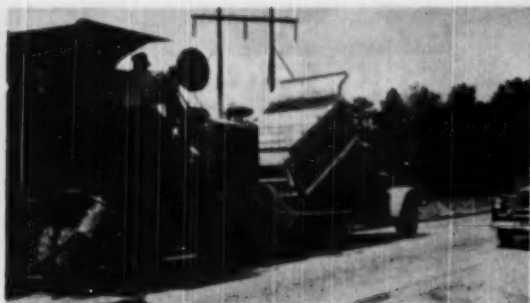
Concreting the strip was a simple operation, performed rapidly by a mobile dual drum 16-E Koehring paver, which also towed a spreader box designed to ride the forms and the slab edge. This 4-sack paver, with its rubber tires and high mobility, proved to be an ideal unit for such work. Sand and gravel aggregates brought in by



★ Liquid membrane curing was used. Each day's work section completed as the job went along

★ A Koehring 16-E mobile paver made fast work of the concreting





★ A specially built spreader box was towed by the paver. Hand strike-off and floating virtually completed the job

rail were dry batched with cement handled in bulk directly from the rail cars, and trucked to the job under flag control from one end of the project.

(Based on a 60-sec. mixing cycle specification, required by the Louisiana state highway department, the Koshring 16E twinbatch paver has a production capacity of 86.7 batches per hour. Using the 10% overload batch, the paver will produce 17.6 cu. ft. of mixed concrete per batch, or 56.5 cu. yd. of concrete per hour.)

Simple Finishing Steps

Finishing operations consisted of striking off with a heavy hand screed, floating with a 3-ft.-wide long-handled wood float, edging, and curing with membrane (Surecure). Expansion joints were installed at 400 ft. intervals, matching the new joints placed in the existing pavement. Dummy joints were cut at about 30 ft. intervals.

Grading and paving the widening strips required a contractor force of about 25 men. Maximum progress was about 2,000 lin. ft. per day.

The T. L. James & Company bid of \$420,000 included a two-course bituminous resurfacing, sublet to Sam Finley, Inc., of Atlanta.

Typical job quantities included the following:

7,218 cu. yd. excavation	@ \$ 1.00
5,600 cu. yd. special borrow	@ 1.00
7,645 cu. yd. p.a. concrete base	
patching	@ 10.00
12,321 sq. yd. p.a. concrete widening	@ 8.50
1,550 tons hot wearing course mix	
(1 1/2-in.)	@ 8.40
7,120 tons bitum. hot binder mix	
(2-in.)	@ 8.40
14,539 sq. ft. RC-2 tack coat,	
(1.5-gal. appl.)	@ .15

The James crew began patching work April 22, and the project was completed Dec. 30, 1949. Patching required extensive time, due to traffic interruptions, weather, and the scattered nature of the work. Base renovation included several major reconstructed sections over bad subgrade, where simple hand strike-off and finishing equipment was used for lane-at-a-time placement.

The subgrade at these places was rolled with 10-ton steel rollers.

The widening was accomplished in a fast-moving sequence during the late summer.

The job was carried out under the Lake Charles district staff of the Louisiana highway department; E. H. Goodloe, district maintenance engineer, B. H. Wade, district construction engineer, L. D. McCorquodale, project engineer. R. A. Womble was project manager, J. B. Reed was construction superintendent for T. L. James & Co., Inc. The "Tragrader" special mold board and spreader box were rented from E. B. Sneed, Pres. of Special Equipment Co., of Austin, Texas.

"Double Tractor" Tried by California Contractor

By combining two "Caterpillar" diesel D8 tractors, Buster Peterson of Peterson Tractor & Equipment Co., San Leandro, California, acquired a single 269-drawbar h.p. tractor for less than the price of two D8's. To achieve this arrangement, Peterson removed one track and final drive assembly from each tractor. A special hard bar was fashioned to allow the two tractors to be bolted together at the final drive housings by a large through bolt. A plate was made and installed on the back of the housings and necessary linkages made for controls, and presto, a "Siamese-twin" tractor. Easy transportation is accomplished by bolting skids under each engine and unbolting the hard bar and final drive housings.

The control system consists of two gear-shift levers, two steering clutch levers, one master clutch lever and two throttles mounted on the left arm rest. The throttles can be used to give gradual power turns as each engine drives one track only. The standard steering clutches may be used for sharp turns or a pivot turn can be executed by having one transmission in reverse and the other in a forward gear.



★ "Siamese" tractor operating with big special double apron



HIGH PRODUCTIVE FACTOR



and the **WARCO** facts behind it

It's the CAB-CONTROLLED BLADE . . . that's the first big reason why the 4D WARCO motor grader yields the high productive factor. The operator bank-slopes in consecutive passes . . . at angles up to 90° . . . and never leaves his cab. There's no need to lose expensive time in backing up or "dead-heading" . . . every foot the WARCO travels is a foot it works!

Cost accounting figures justify the good judgment of contractors and highway departments who are investing their money wisely in WARCO. On big jobs and small . . . the 4D WARCO delivers the high productive factor. See the WARCO in action . . . 100 HP and 76 HP . . . that's the way to find out.

Here's Why WARCO Yields the HIGH PRODUCTIVE FACTOR

90° BLADE TRAVEL from one side to the other, cab-controlled • RETRACTABLE SCARIFIER blade revolves 360° without removing scarifier or teeth • HIGH WORKING CLEARANCES front and rear • INTERCHANGEABLE WHEELS • MECHANICAL STEERING with hydraulic booster • HYDRAULIC CONTROLS give immediate and positive response.

APPROXIMATE WEIGHT IN LBS.

Model No. and H. P.	TOTAL	ON FRONT WHEELS	ON REAR WHEELS	BLADE PRESSURE
HEAVY DUTY 4D-100				
Without Cab or Scarifier	22,879	6,617	16,262	11,900
With Cab and Scarifier	24,593	7,774	16,819	13,922
GENERAL DUTY 4D-76				
Without Cab or Scarifier	21,356	6,279	15,077	11,205
With Cab and Scarifier	23,070	7,436	15,634	13,227

W. A. RIDDELL CORPORATION • Bucyrus, Ohio
BUILDERS OF WARCO MOTOR GRADERS • HERCULES ROAD ROLLERS

Additional facts on products described below can be obtained from the manufacturer via postcard inserted at page 96. Each item is numbered. Just circle the corresponding number on the card and mail.

(Continued from page 97)

to give double assurance of dependable, fast and sure priming. Higher efficiency is claimed because no recirculation occurs after the pump has picked up its



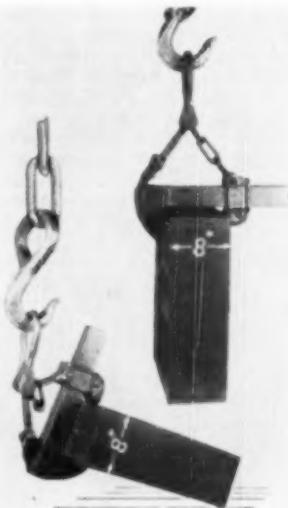
New Ohler Pump.

prime. "Dual Volutes," stated to be incorporated for the first time in a pump of this type, makes it possible for one of the volutes to discharge at the bottom of the case keeping it thoroughly flushed out and clean. The other volute discharges above the recirculation ports so that the entrained air removed during the priming cycle will more readily separate and escape and not be recirculated so as to retard priming.

33

Hoisting Clamp

A new clamp, announced by Merrill Brothers, Arnold Ave., Maspeth PO, New York, N.Y., lifts from horizontal to vertical without adjustment. The clamp will lift any metal object up to 12 in. thick that its adjustable jaws can grip. Two clamps are available, one with a rated



Merrill Adjusta-Clamp

capacity of 1 ton and weighing 30 lb. The other has a rated capacity of 3 tons and weighs 60 lb.

MANUFACTURERS' LITERATURE

34

Portable Compressor

A new bulletin on its Blue Brute 60' portable compressor, Contractors Model, has been issued by Worthington Pump and Machinery Corporation, Harrison, N.J. It contains an illustration showing the principal features of the compressors. Specifications are included as well as table showing the number of tools that can be operated simultaneously by the compressor.

35

Steel Flooring

A new bulletin on various designs of open steel flooring issued by Kerlow Steel Flooring Co., Jersey City, N.J. describes and illustrates forged and welded rectangular patterns and also a triangular reticulated pattern. The bulletin also gives dimensions of each design of grating and safety step and includes a safe load table.

36

Bottom-Dump Euclid

Several improved features of the new Model FDT bottom-dump Euclid are illustrated and described in a new catalog folder issued by The Euclid Road Machinery Co., Cleveland, O. Some of these improvements are the option of 21.00 x 25 or 24.00 x 25 drive and trailer tires, air assist clutch, 190 or 200 h.p. diesel engine, new driver seat, and a new trailer hopper design that sheds wet, sticky material fast and clean.

37

Concrete Vibrators

The line of Syntro concrete form vibrators, concrete mass vibrators of the flexible shaft type and vibrating concrete floats are illustrated and described in a new bulletin issued by Syntro Co., Homer City, Pa. Two models of vibrating floats, two models of concrete form vibrators and two models of mass concrete vibrators are pictured and described.

38

Heat Treated Alloy Steels

New bulletin brought out by Joseph T. Ryerson & Son, Inc., Chicago, Ill. gives engineering data on two high performance alloy steels supplied in the heat treated condition, ready to use. These heat treated steels are suitable for heavy duty axles and shafts, gears and pinions, studs and bolts, etc. Data tables include: minimum mechanical properties, test results, properties at high temperatures, and machinability ratings.

39

Packaged Pipe Line

A new 4-page brochure on its "Speed-Lay" pipe system published by Albert Pipe Supply Co., Inc., Brooklyn, N.Y. describes a packaged pipe line (including pipe, couplings, valves and fittings) furnished to order in exact lengths. Light-weight, easy to install and economical for temporary air and water and gas lines.

STEP UP YOUR PAVING PROFITS!



JACKSON SIDE FORM VIBRATOR

Eliminates manual vibrating of concrete at side forms. Saves the better part of two men's labor. Mounts on any modern finisher, Jackson Vibratory Paving Tube or spreader. Employs two or more vibratory units that are simultaneously lowered into or raised from the concrete by the finisher operator. Units operate close to forms or reinforcement without fouling — ride over any obstruction encountered. Will not penetrate into sub-base. Assures thorough compaction regardless of speed of finisher or spreader — no spots missed. Long-wearing, trouble-free.*



JACKSON VIBRATORY PAVING TUBE

Quickly makes plastic the stiff, drier concrete mixes which effect up to 10% cement savings. Concrete at forms or joints is, under most conditions, puddled perfectly, thus saving manual vibrating. Reduces spreading cost, steps up finisher progress. Complete compaction, the full width of the slab, and excellent finish is obtained. Perfectly adaptable to slabs 6" to 24" thick and for regular single or two-course construction. Easily adjustable in the field from 10' to 25' slab-widths. Quickly attachable to any standard finisher. Ample power to offset fast drying and setting conditions.*

JACKSON PORTABLE POWER PLANTS generate both single phase and 3-phase 115 volt, 60 cycle AC. Ideal for lights and power tools. Capacities: 1.25 to 5 KVA.

OTHER JACKSON VIBRATORY EQUIPMENT — perfect for every type of concrete placement.

FOR SALE or RENT at your Jackson distributor.* Get your **FREE** copy of the Jackson "Pocket Guide" showing complete line.



MANUFACTURED BY ELECTRIC TAMPER & EQUIPMENT CO. FOR
JACKSON VIBRATORS, INC., Ludington, Mich.

SISALKRAFT CURING BLANKETS FOR MORE THAN 20 YEARS

*Designed • Developed
Proven*
BY ROADBUILDERS



THE SISALKRAFT METHOD ASSURES

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- ✓ Fifteen re-uses, or more.
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VALUABLE
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THE SISALKRAFT CO.

Chicago 6 • New York 17 • San Francisco 5

Additional facts on products described below can be obtained from the manufacturer via postcard inserted at page 96. Each item is numbered. Just circle the corresponding number on the card and mail.

40 Diesel Engines

A new 16-page illustrated booklet issued by Caterpillar Tractor Co., Peoria, Ill., contains first hand, complete information on Caterpillar's latest and most powerful Diesel engines, models D397, D398, D375, and the D364. The booklet covers the outstanding advantages and qualities in "Caterpillar" Diesel engines and is complete with specification and performance charts.

41 Darkener for AE Concrete

A new carbon black dispersion specifically designed to darken air entrained concrete without reducing the air content of the mix is described in a circular of A. C. Horn Co., Long Island City, N.Y. Data on mixes and tables of compressive and flexural strength are given, as well as a table showing the favorable effect of Horn's A.E. Black on air entrainment.

42 Concrete Test Cylinder Molds

The Moline concrete test cylinder molds for making concrete compression test specimens are featured in a circular of the Moline Iron Works, Moline, Ill. Illustrations are given of the steps in making a concrete test cylinder in a Moline Mold. The features of the molds are fully described.

43 Conveyors

A new 52 page conveyor booklet published by Pioneer Engineering Works, Minneapolis, Minn. covers two plans for ordering conveyors, with Plan 1 covering pre-engineered conveyors and Plan 2 covering job-engineered types. The booklet shows how you can solve your conveyor problems as well as most experts. It shows how to specify and order the conveyor you need, without a lot of technical formulas and figures. In two colors, and profusely illustrated with conveyor photos and job applications the booklet is complete with tables to simplify conveyor selection.

44 Diesel Tractor

A new 29-page illustrated booklet, entitled "Caterpillar" D8 diesel tractor, released by Caterpillar Tractor Co., Peoria, Ill., features the D8's ability to get things done effectively, efficiently, and with a minimum of "time out" for maintenance and repair. Quality features of this diesel track-type tractor are discussed and illustrated along with complete specifications.

45 Rubber in Highway Construction

The background of the use of rubber in road construction and what has been done to date in this development are summarized in a 26-page booklet, written by Harry K. Fisher, Rubber Road Consultant, and published by the Natural Rubber Bureau, 1631 K St. NW, Washington, D.C. The booklet outlines the work done by paving engineers of The Netherlands and of Java and describes tests made in the United States. Details are given of test

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We call our new core drill the "Teredo" because it will out-bore any other machine of its size. This light, compact, portable core drill will recover cores up to 2 1/4" in diameter and operate at depths to 600'. It can be mounted on drag skids, jeep, truck or trailer; and powered by air motor, electric motor, gasoline or diesel engine or truck take-off. It's simple, rugged and relatively inexpensive. Either mechanical screw feed or hydraulic feed can be furnished. Send for Bulletin 30 RS.



ACKER DRILL CO., INC.
Scranton 3, Pa. U. S. A.

roads using natural rubber laid in 1949 in Virginia, Ohio, Texas, Minnesota and Canada.

46

Rotary Pumps

The rotary pumps of Blackmer Pump Co., Grand Rapids, Mich., are illustrated and described in a 40 page catalog. Sections are included on design and operating data, construction details, sanitary pumping units, truck pumps, and types of installation. Eight pages are devoted to capacity and horsepower tables. Specifications for the various types of pumps are included.

47

Sickle Blade Sharpener

The Edgemaster, a sickle blade sharpener, is described in a circular of Pneu-Hydro Road Machinery Co. Cadillac, Mich. It is stated that with this machine a blade can be removed from a cutter bar and completely resharpened in 5 minutes.

48

Calcium Chloride for Consolidated Roads

Brief SB-1 "Calcium Chloride for Surface Consolidated Roads" is the title of a two page, condensed report now available from the Calcium Chloride Association, Ring Bldg., Wash. 6, D. C. It describes proper maintenance procedures for reshaping gravel roads, adding new materials, and applying calcium chloride.

49

Steel Tapes, Levels, Transits

Many new items are included in a 36-page catalog on its precision steel tapes, levels, transits and tools just issued by The L. S. Starrett Co., Athol, Mass. Covered by the catalog are steel tapes, pocket tapes, special tapes, transits and leveling instruments, targets and plumb bobs and draftsman's tools.

50

Land Clearing Blade

An interesting section of a bulletin regarding its Carco land clearing blade issued by Pacific Car and Foundry Co., Renton, Wash., tells how to cut land clearing costs. Descriptions of the features of the blade are illustrated and described, and specifications are given. Illustrations show the blade engaged on various land clearing operations.

51

Highway Guard Rail

A new, illustrated, and informative 16-page booklet, "Flex-Beam Guardrail and bridge rail," published by Armco Drainage & Metal Products, Inc., Middletown, O., shows how Flex-Beam contributes to economical highway safety, and supplies technical data for the designer of highway guardrails. The booklet outlines the factors influencing guardrail design and then points out how Flex-Beam meets highway safety needs in a variety of service conditions. Photographs show actual installations. A special section shows how Flex-Beam bridge rail can be used to make bridges safer and more efficient. Also included are 8 pages of basic design data.

Gorman-Rupp's Handle Low Water Crisis at Rye Lake



When Rye Lake, Westchester County, New York, receded, cutting off three villages from water supply, the crisis was met by putting dependable Gorman-Rupp pumps on the job.

240-M
10 inch



THE WORLD'S MOST COMPLETE LINE ... OF SELF-PRIMING CENTRIFUGAL PUMPS

Whatever the job requires: a tiny twenty pound "Handy" pump, a lightweight "Midget" pumping 5500 GPH. or a pump handling up to 240,000 GPH. you will find the most efficient pump is the Gorman-Rupp.

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HIGHEST PRIMING: High suction lifts are easy for Gorman-Rupp Pumps.

FASTEST PUMPING: More water per gallon of fuel than any other comparable pump.

DEPENDABLE: The most simple pump built — will not clog. Trouble-free, requiring a minimum of maintenance.

GUARANTEED IN PLAIN LANGUAGE by Manufacturer and Distributor. Ask for copy of our guarantee.

Write for new Contractors' Bulletin 8-CP-11.



GORMAN-RUPP COMPANY

MANSFIELD, OHIO

NEW GIANT ALLOY adjustable wrenches

REPLACE 29 SIZES
THINNER • LIGHTER
STRONGER



Now for the first time quality, light-weight, alloy steel adjustable wrenches drop-forged to stand up under heavy duty jobs. The OTC Slim Twin make tough jobs easy - save tool and time costs - result in faster, more productive work in your shop or on emergency calls. The OTC Slim Twin Wrenches replace 29 standard size wrenches.

OA-34 is 34" long, 7/8" thick and weighs only 10 lbs. Adjusts to 13 standard sizes from 1-3/8" to 2-7/8". OA-36 is 36" long, 1-1/8" thick and weighs only 22 lbs. Adjusts to 16 standard sizes from 2-15/16" to 4-3/4".



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RAISES ITS
DECK TO
CLEAR HIGH
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It embodies the kind of versatility that makes every haul easier, faster, more profitable.

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It's equally as rugged as the standard Rogers Gooseneck regardless of its detachable feature. And it's available on most Rogers Trailers and adaptable to many trailers of other makes.

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EXPERIENCE builds 'em

PERFORMANCE sells 'em

ROGERS BROTHERS CORPORATION, 110 Orchard St., ALBION, PA.

WITH THE MANUFACTURERS & DISTRIBUTORS

New Keystone Representative. William D. Redhead has been appointed sales representative for Keystone Asphalt Products Co., Chicago, Ill. He will cover the states of eastern Tennessee, North Carolina, South Carolina, Alabama, Georgia and Florida. His headquarters will be in Atlanta, Ga.

Cowan Transferred by Macwhyte. James A. Cowan has been transferred to Pittsburgh, Pa., as direct factory representative for Macwhyte Co., Kenosha, Wis. His headquarters will be at the Pittsburgh office, 704 Second Ave.

Kerr Promoted by Marion. Ralph W. Kerr, heretofore assistant service manager, has been appointed sales representative for Marion Power Shovel Co., Marion, O., for Michigan and western Ohio. His headquarters will be in the company's general offices in Marion. He succeeds John Hildinger, who resigned to join Decca Detroit Corporation, Detroit, Mich., distributor of Marion excavating equipment.

New Johnson Distributor. E. M. Wake-man & Associates, 2806 Carolina Ave., Lakeland, Fla., has been appointed a distributor for C. S. Johnson Co., Champaign, Ill., for northern Florida and southern Georgia.

Holmes Promoted by Koppers. R. R. Holmes, assistant general manager of the Tar Products Division of Koppers Co., Inc., Pittsburgh, Pa., has been appointed vice president in that division. Mr. Holmes joined the company in 1923 in the accounting department. In 1944 he was made manager of the Koppers White Tar Division at Kearny, N. J. He returned to Pittsburgh in October, 1947, to become sales manager of the Tar Products Division.

New Joy Distributor. Coast Equipment Co., 348 Bryant St., San Francisco, Calif., has been appointed exclusive northern California sales and service representative for Joy Manufacturing Co., Pittsburgh, Pa.

Kinney Moves Chicago Office. Kinney Manufacturing Co., Boston, Mass., has moved its Chicago branch office from Socany-Vacuum Bldg., 59 East Van Buren St., to Room 1313, Peoples Gas Bldg., 122 South Michigan Ave. The branch office continues in charge of Alfred J. Munday who has been with the company since 1917.

Hercules Relocates Houston Branch. Hercules Motors Corporation, Canton, O., has moved its Houston, Tex., branch from 1319 Conti St., to 6818 Navigation Blvd.

New Sales Division for General Tire. Formation of a northeast sales division for The General Tire & Rubber Co., Akron, O., with James W. Haggerty, of Boston, as top executive has been an-

nounced by L. A. McQueen, vice president in charge of sales. The northeast division combines General's Boston and Buffalo branches under Haggerty's office, which will continue at 119 Braintree St., Boston. David G. Gehring, Cortland, N. Y., will be manager of the Boston Branch, and Elmer H. Menger, New Castle, Pa., Buffalo branch manager.

Gulf Oil Appointment. Nevin T. Brenner has been appointed chief fuels and lubricants engineer, Tractor Section, Automotive Products Engineering, for Gulf Oil Corporation, Pittsburgh, Pa.

Fenner Made General Sales Manager. A. F. Fenner, vice president of Mack International Motor Truck Corporation, has been named general sales manager, with headquarters in Chicago. He will direct all of the company's truck, bus and fire apparatus sales and service activities in its Central, Southwestern and Pacific Coast Divisions, as well as the Republic of Mexico.

Paris Joins Marlow Pump. Fred R. Paris, for 10 years with Worthington Pump and Machinery Corporation, has been appointed district representative for Marlow Pumps, Ridgewood, N. J. Working out of the firm's home office in Ridgewood, he will be in charge of construction pump sales for New York state and part of Canada.

Noel Joins Tractomotive. Marshall L. Noel has joined Tractomotive Corporation, Deerfield, Ill., as vice president and treasurer. Mr. Noel is well known in the construction machinery field, having spent more than 21 years with the Tractor Division of Allis-Chalmers. Prior to becoming associated with Tractomotive Corporation, Mr. Noel was vice-president of Allis-Chalmers Manufacturing Co. and general sales manager of the Tractor Division.

Caterpillar Appointments. Frank S. Foster, heretofore assistant sales manager, Eastern Division of Caterpillar Tractor Co., Peoria, Ill., has been appointed assistant sales manager, Western Division. He replaces Truman E. Sage who resigned to join the Caterpillar distributor for Alaska, Northern Commercial Co., Seattle. Gordon J. Fowler, district representative in the San Joaquin Valley, California, has been promoted to assistant sales manager, Eastern division.

Davidson Elected Vice-President. David F. Davidson has been elected vice-president for sales of Link-Belt Co., Chicago, Ill. He has been general manager of the company's Pershing Road, Chicago, plant since 1947. Eugene P. Berg, formerly assistant general manager succeeds Mr. Davidson as general manager at Pershing Road.

Federal Truck Appointments. E. R. Guy has been appointed factory sales representative for Federal Motor Truck Co., Detroit, Mich., in the Des Moines region. He will direct dealer relations and sales activities in Iowa, Nebraska, southeast South Dakota and the Missouri River counties. Charles A. Phillips has been appointed factory sales representative in the Denver region. He will service dealer relations and coordinate merchandising and sales activities in Colorado, New Mexico and southern Wyoming.

The Ninth of a Series in the interest of more efficient use of steel... a vital American resource

LACLEDE MULTI-RIB

REINFORCING BARS

NOW... Available by Number in
Standard Sizes of New A.S.T.M.
Serial Designation
A305-49 Table I



Thanks to A. S. T. M. specification A305-49, designers now have a more efficient bar for concrete reinforcement... one that provides increased anchorage which when properly used will give appreciable savings in steel and concrete. Advanced design Laclede Multi-Rib Reinforcing Bars exceed the A305-49 specification. They are available in uniform round sections in all standard sizes and can now be ordered by number.

TABLE I A.S.T.M. SERIAL DESIGNATION A305-49
Dimensional Requirements for Deformed Steel Bars for Concrete Reinforcement

Bar No.	Unit Wt. Lbs./Ft.	NOMINAL DIMENSIONS ROUND SECTIONS			REQUIREMENTS OF DEFORMATIONS		
		Diameter-Inches Decimal	Cross Sectional Area Sq. Inches	Perimeter	Max. Avg. Spacing Inches	Min. Height Inches	Max. Gap, Inches 1
3	0.376	.375	0.11	1.178	0.262	0.015	0.143
4	0.668	.500	0.20	1.571	0.350	0.020	0.191
5	1.043	.625	0.31	1.963	0.437	0.028	0.239
6	1.502	.750	0.44	2.356	0.525	0.038	0.286
7	2.044	.875	0.60	2.749	0.612	0.044	0.334
8	2.670	1.000	0.79	3.142	0.700	0.050	0.383
9*	3.400	1.128	1.00	3.544	0.790	0.056	0.431
10*	4.303	1.270	1.27	3.990	0.889	0.064	0.487
11*	5.313	1.410	1.56	4.430	0.987	0.071	0.540

*These sections have the same weight and area as bars formerly known as 1" Sq., 1 1/8" Sq. and 1 1/4" Sq.

*Chord of 12 1/4% of Nom. Perimeter

*Bar numbers are based on number of 1/8" included in the nominal diameter of the bar section.

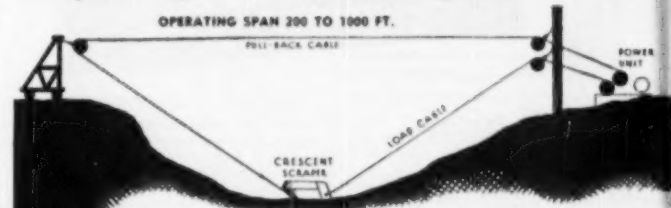


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About specifying LACLEDE MULTI-RIB BARS on your jobs

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St. Louis, Mo.

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with a SAUERMAN SCRAPER



Sauerman Scraper is good tool for stockpiling as well as for excavating. Above is small Sauerman unit that shoves and reclaims aggregate at grading plant.

Continuously, steadily, the powerful Sauerman Crescent scoop goes back and forth—making more hauls per day—delivering more yardage and doing it for less cost. It is at its best on difficult work, such as cutting down a hill, handling hard-packed or sticky material, stockpiling, digging ponds, etc.

Payroll savings too. Only one man is needed to control the entire operation of the machine and handle the small maintenance. Extreme simplicity of design and construction insure the long life and dependable service of this equipment. Fuel requirements; either Diesel, electric or gasoline, are very small on the basis of yardage handled.

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SUsquehanna 7-1900

Special Weekly
and Monthly rates

New Koehring Distributors. The Koehring Co., Milwaukee, Wis., has announced the following new distributor appointments and the opening of the following new distributor branch offices. All of these dealers will represent Koehring and its subsidiary companies: Kwik-Mix Co., Port Washington, Wis.; C. S. Johnson Co., Champaign, Ill.; and Parsons Co., Newton, Ia. The Rowen-

Lesby Co., 40 Midland St., Hartford, Conn., has territorial assignments in the states of Massachusetts and Connecticut. Lou Garis Equipment Co., 2921 Second Ave. South, Birmingham, Ala., will represent Koehring and its subsidiary companies in Alabama and Northwestern Florida. The Empire Equipment Co., Sioux Falls, S. Dak., has opened a new branch office at 823 Third Ave., Aberdeen, S. Dak. Moore Equipment Co., Inc., Stockton, Calif., now have a branch office at 303 Del Paso Blvd., North Sacramento, Calif. W. W. Williams Co., Columbus, Oh., has opened a branch office at 1260 Conant St., Maumee, O.

New Sales Manager A-C Tractors. R. S. Stevenson, heretofore assistant general sales manager, has been appointed general sales manager of Allis-Chalmers Tractor Division. He succeeds Marshall L. Noel, who resigned recently for personal reasons, and whose resignation, the company announced, was accepted with regret. Mr. Stevenson has been connected with Allis-Chalmers since 1933 when he became a salesman in the Kansas City branch. Two years later he became assistant manager of the company's branch at Omaha, Neb. In 1936 he was transferred to the Milwaukee home office as assistant southwest terri-

tory manager, and later that year was appointed manager of the Northwest Territory. In 1941 he was appointed Southwest territory manager, remaining in that position until the fall of 1945 when he became assistant general sales manager.

New Riddel Representative. Robert D. Mathews has been appointed District Representative for W. A. Riddell Corporation, Bucyrus, O., in the states of Missouri, Kansas, Oklahoma, Arkansas, Louisiana and Texas. Mr. Mathews has been associated with the heavy construction industry for many years. Part of this time was spent as a sales engineer for one of the major oil companies, specializing in the lubrication problems of construction machinery.

Euclid British Plant. The Euclid Road Machinery Co., Cleveland, O., has established a subsidiary, Euclid (Great Britain) Ltd., to manufacture Euclid earth moving equipment in Great Britain. Manufacturing facilities in Glasgow, Scotland have been leased from the British Government. Initial production will concentrate on the 15-ton rear-dump hauler, but other models will be built later. The British product will be built to the same standards and design that have given Euclid equipment favorable acceptance throughout the world. Practically all component parts of the 15-ton model will be manufactured in Britain to Euclid specifications. H. T. Monson, in charge of industrial engineering and factory management at the Cleveland, O., plants, will be managing director of the English operation.

Senator Chavez Introduces \$962 Million Highway Bill

SENATOR Chavez (D. Mex.) Chairman of the Senate Committee on Public Works, on April 14 introduced legislation continuing federal-aid for the fiscal years 1952 and 1953. The new bill (S. 3424) carries total annual authorizations amounting to \$962 million. Of this total, regular federal-aid amounts to \$550 million with additional authorizations of \$100 million and \$150 million for the Interstate System and local roads, respectively. A breakdown of the annual authorizations for the two-year period follows:

Primary, Secondary and	
Urban	\$550 mill.
Forest highways	25 mill.
Forest roads and trails	20 mill.
National park roads	15 mill.
Parkways	15 mill.
Indian roads	10 mill.
Interstate System	100 mill.
Emergency fund	10 mill.
Inter-American fund	8 mill.
Nicaragua roads (lump sum)	8 mill.
Access roads (lump sum)	50 mill.
County roads	150 mill.
Total	\$962 mill.

The F-A authorization of \$550 million is allocated as follows: 45% for

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CLAY DIGGING TOOLS**

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sizes to fit all standard compressed air
hammers.

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**TOOLS — THE WORLD OVER —
NOTED FOR QUALITY AND DURABILITY**

VULCAN TOOL MFG. CO.
QUINCY, ILL.

projects on the primary system; 30% for projects on the so-called secondary system and 25% for projects on the urban system. These funds are allocated to the states in accordance with the present Federal-aid formula for distribution with the proviso that up to 25% of the amount apportioned to any state for the Federal-aid primary and Federal-aid secondary systems may be transferred from one fund to the other. Matching basis, 50-50.

The 100-million-dollar fund for Interstate highways is to be allocated in accordance with existing provisions of law and matched on a 50-50 basis which differs from a pending House bill providing a 75-25 matching basis.

The \$150 million authorization for so-called "county roads" would be administered under the supervision and approval of the U. S. Bureau of Public Roads. The term "county roads" means any rural local road not presently on the secondary road system of a state.

The county road fund would be allocated to the states, and in turn to the counties or parishes of each state, on the same formula presently employed for distribution of the secondary Federal-aid fund. A new formula for sharing costs of construction is introduced with regard to "county roads": the Federal Government's share would be 40% of the cost; the state 25% of the cost, and the county or parish 35% of the cost. It is further provided that the cost of the Federal Government shall not exceed \$4 thousand per mile.

Immediately upon introduction the bill was referred to the Senate Committee on Public Works, and hearings were scheduled for an early date.

Pennsylvania Awards \$39,000,000 in 1st Quarter

Seventy-four contracts totaling \$38,894,700 were awarded in the period between Jan. 1 and April 15.

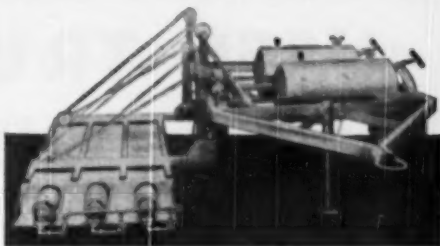
White SURFACE HEATERS

Why destroy pavement base to apply new surface?

These heaters melt 1" of old asphalt in 5 minutes. New top can be placed without damaging base.

Sizes: 4 x 6'; 3 x 6'

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ELKHART White Mfg. Co. INDIANA

Off-street Parking Progress

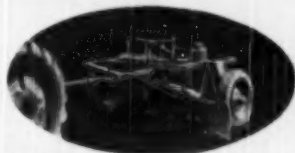
Denver—The city has accepted a proposal by a banking syndicate headed by Otis & Co., to issue tax exempt bonds for \$3,700,000, to finance off-street parking facilities for the downtown area. The proposal is based on an engineering survey by Coverdale & Colpitts. An ordinance is pending to issue serial bonds which would bear 3 1/4 % and 3 3/4 % interest and be retired by parking meter revenue.

Boston—Legislative approval permitting this city to spend an additional \$5,000,000 on parking facilities was passed by the Massachusetts House recently.

Rhode Island Plans Long-Range Studies

Rhode Island law creates an eleven-member special commission to study and analyze the many financial aspects and other problems relating to a long-range road building program, including the north-south freeway. The commission (made up of 4 legislators and 7 appointees of the governor) is required to render reports from time to time prior to Dec. 31, 1950, so that necessary legislation may be enacted during this session of the General Assembly.

THE YORK RAKE



Redistributes the windrow left by a Grader Blade and, simultaneously, "screens" the oversize stones, carrying them to the side of the road, leaving a perfect driving surface.

Is valuable for roadside improvement and landscaping—levels the surface—rakes the stones into a windrow so they may be easily picked up—leaves a perfect seed bed.

Is adapted for use behind Power or Drawn Graders, light Tractors or Trucks. Saves time and labor.

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UNADILLA, N. Y.

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DEEP
PENETRATION**

**TWO
FULL
LOADING**

**THREE
EASY
DISCHARGE**

Owen Buckets

for HI-SPEED OPERATION

THE OWEN BUCKET CO.
6070 BREAKWATER AVE., CLEVELAND, O.
BRANCHES: New York, Philadelphia, Chicago, Berkeley, Cal.

USED TRUCK MIXERS FOR SALE

ALL late models mounted on trucks and unmounted
ALL MAKES and SIZES from 3 yards to 5½ yards
Both HORIZONTAL and HI-DISCHARGE

Also 50 used late model Jaeger Building Mixers, sizes 6EL, 11EL,
16EL, mounted 2 Pneumatic tires. Reconditioned. Immediate de-
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THE GIROD COMPANY, INC.

P.O. Box 847
VICKSBURG, MISSISSIPPI

Sealed bids will be received by this firm until May 19, 1950, at 3:00 P.M., and then publicly opened for the sale of the following surplus equipment:

14 2-cu.-yd. Blow-Knox Hi-Bay
Truckmixers, mounted on Chev-
rolet G.I. 4 x 4 Trucks. Truck-
mixers are 1947, 1948 and
1949 models.

Bids may be submitted for any or all units but must be for the complete units (Truck and Truckmixer).

Equipment is in generally good condition and may be inspected at Greenville, Mississippi, after appointment with The Girod Company, Inc., of Vicksburg, Mississippi, the owners, who retain the right to reject any or all bids.

Inquiries should be addressed to the owners at the above address or to telephone 2959, Vicksburg, Mississippi.

FOR SALE

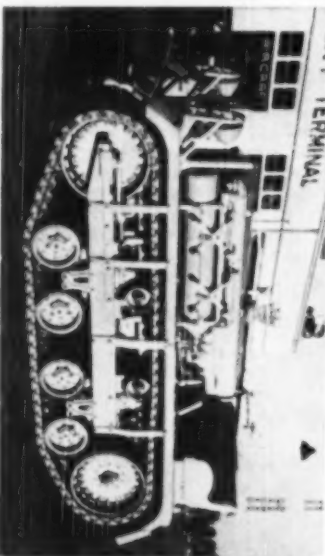
- 1-CUM 3000 End Discharge Mixer, 2 pneumatic tires.
- 1-Hoffman Model 112, 100" portable Air Compressor.
- 1-Allis Chalmers Model 80-60 Tractor.
- 2-Allis Chalmers Model 80-60 Tractors.
- 1-Pontiac Concrete Bldg. 2 part.
- 2-Pontiac Concrete Bldgs. 3 part, one mounted on 1941 Dodge.
- 1-Nelson 1/2 ton Buckle Loader, Model K-5.
- 1-Offroad Wheel Tractor, Model "W" 400 7/8 part track and loader.
- 1-Newco Motor Grader, Model W-100, 70 H.P. drive.
- 1-Allis Motor Grader, 70 H.P. gas.
- 1-4 x 6, three deck strand saw.
- 1-Baldwin 1, 1000-100000 Tractors with 100, 1000, 10000 scrapers.
- 1-Pontiac Model 400, combination Model and Crane.
- 1-P & H Model 213-A Shovel, Dragline or Backhoe.
- 1-Northeast, Model 25, shovel attachment.

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CLETRAC TRACTORS

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OUR PRICE \$1000.00 each

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Dever, Delaware

REBUILT CONSTRUCTION EQUIPMENT GUARANTEED

TRACTORS

Caterpillar—Allis Chalmers
International

POWER SHOVELS or CRANES

Lorain—Koehring—Buckeye

SHOVEL FRONTS UNUSED

For North West 25—North West 6
North West 80D—Manitowoc 2000B

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ROAD ROLLERS

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Buffalo Springfield 10 Ton
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Wabash 2-4911

New and Used Equipment For Sale or Rent at Bargain Prices

To reduce our stock of new and used equipment quickly, we are offering the following at attractive prices. Nearly all the used equipment has been overhauled and put in first class condition in our own yard, and can be inspected there. All prices quoted F.O.B. Omaha, Nebraska, unless otherwise designated. Subject Prior Sale.

AIR COMPRESSORS

1. Le Roi Model 60 on 2 pneumatic tires—new July, 1948. Good condition. Serial No. 211 X 467
2. Jaeger Model 105 on pneumatic tires—good condition.
3. Le Roi Model 105, No. 263 X 340, on pneumatic tires—New in 1947
4. Le Roi Model 160, No. 231902, on pneumatic tires—New late in 1947—Good condition
5. Le Roi Model 160, No. 208491, on pneumatic tires—New 1945—Good condition
6. Schram Air Compressor, Model 85, No. 13227
7. Le Roi Model 105G2-E, No. 237269, mounted on 2 pneumatic tires. New in 1948

AIR TOOLS

We have in stock approximately 100 used air tools, mostly Thor, including paving brooms, tampers, rock drills, etc. These are in good condition at various prices.

BIN-BATCHER

8. Butler 2-compartment, 105-ton capacity material bin with batchers

BUCKETS

9. Blaw-Knox $\frac{1}{2}$ cu. yd. Rehandling Bucket Model 604-1, H-2372. Practically new
10. Omaha $\frac{3}{4}$ -yd. Dragline Bucket, No. 7552—Good condition
11. Blaw-Knox $\frac{1}{2}$ -cu. yd. Rehandling Clamshell Bucket, Model 604-1, H-3058. Good condition
12. Blaw-Knox $\frac{1}{2}$ cu. yd. General Purpose Clamshell Bucket, Model 666, H-2739. Good condition
13. Williams 2 cu. yd. Dragline Bucket, Model GP-X, No. 5780. Good condition
14. Blaw-Knox $\frac{3}{4}$ cu. yd. General Purpose Clamshell Bucket, Model 672, H-2745. Good condition
15. Page $\frac{1}{2}$ cu. yd. Dragline Bucket, 2-1493. Good condition
16. Blaw-Knox $\frac{1}{4}$ cu. yd. Rehandling Wide Barge Type Bucket, Model 7125, AA-7082. Good condition
17. Blaw-Knox 1 cu. yd. General Purpose Bucket, Model 680, AA-5376. Good condition
18. Omaha 1 cu. yd. Standard Dragline Bucket, No. 3303. Fair condition
19. Blaw-Knox $\frac{3}{4}$ cu. yd. General Purpose Bucket with teeth. Model 672, H-5282. Good condition
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BULLDOZER

21. New Wooldridge BD7, No. 7250. Equipped for use with D7 Tractor

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22. New Barber-Greene Self-Propelled Model 92, No. 92-48-2, 5 H.P. electric motor, 220 440 volt

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23. Jaeger Model D Concrete Finisher, adjustable 20 to 25'. Not overhauled, but in working condition
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39. Wooldridge PCU WE 2 (D7) 7M, No. 18293. This is a NEW unit for D7 Tractor, and is equipped with Universal Fairleads
40. Wooldridge PCU WE 2 TD-18, No. 18294. A new unit for TD-18 Tractor with Universal Fairleads

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41. Seaman Pulvi-Mixer, Model MHD-72, No. 1338. Overhauled. In good condition
42. Seaman Pulvi-Mixer, Model MHD-72, No. 1259. Overhauled. In good condition
43. Seaman Pulvi-Mixer, Model MHD-72T-55K, No. M-2466. 4 speed transmission. NEARLY NEW

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44. Gorman-Rupp 6" Model H16A, No. 2224, D-201 Le Roi motor, mounted on steel wheels. Overhauled and painted. First class shape
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46. 1—Broas Model 167, Serial 2059, 13 wheel pneumatic tired roller. Fine condition

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47. Caterpillar Model 12 Diesel Powered, Serial No. 9K-2457, with 4—13.00x24 heavy duty Firestone tires and 2—7.50x24 Firestone tires. Overhauled and in excellent shape. Tires nearly new

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2280" x 2292", 2292" x 2304", 2304" x 2316", 2316" x 2328",
2328" x 2340", 2340" x 2352", 2352" x 2364", 2364" x 2376",
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9912" x 9924", 9924" x 9936", 9936" x 9948", 9948" x 9960",
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Front end loader Model 9 Scoopmobile with cable-controlled bucket. Excellent condition. Reasonable.

Power grader—Galion Model 201 with scarifier and cab. Will trade on bulldozer.

Conveyor, 30 ft. 18 in. Diamond-lattice frame conveyor, 1/2 ton.

40 ft. 18 in. conveyor and Austin-Western revolving screen, ideal for sand screening. Cheap.

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Model B-12 Inley Dragline Crane with Bucket year 1948 \$7,750

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T-D14 Bulldozer year 1947, Excel. Cond. \$5,950.00

Adams Pelt Grader 12 ft. blade, Excel. Cond. \$750.

10 yd. Dump Truck \$2,700

A large Assortment of Clim & Dragline Buckets.

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1—Erie B2 Steam Crane, 45 H.P. Boiler, 40' Boom (ideal for pile driver).

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GRADATION UNIT FOR BARBER GREENE 848 MIXER

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Caterpillar equipped with winch, 2-cyl. Ingersoll Rand compressor, 2000 lbs. capacity, 1800 volt mounted on right feeder, rubber tracks, \$500.00 change or \$1,000.00 at Minneapolis.

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1—1947 Truck-mounted Worthington Compressor, 105 with jackhammer, paving breaker, paving bits, spades, etc. \$2400

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1—30 ft. heavy constructed Crane boom 2 section \$500.00

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MAIN STREET SOUTH MERIDEN, CONN.

USED HEAVY DUTY TRUCKS FOR DUMP OR TRACTOR WORK

'45 Reo, GMC 361 cu. in. eng. and trans. Completely rebuilt. A steal.

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'48 GMC 4-cyl. Diesel. In perfect shape. Fully equipped.

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La Plant Scraper, Model TS-300

Shovels: 38B Bucyrus, 1201 Lima, 80 Lorain, 75B Lorain (2), 10B Bucyrus Shovels & Backhoes (2), 40a-Marion Drag & Shovel

Shovel front for 2000 Manitowoc New Unit, 3/4 yd. Shovel. Heavy duty. \$2,000 under list.

Brand New, C. P. Caterpillar Diesel Engine, 315 ft., on steel wheels with wagon drill and tools. Outfit new \$12,000. Our price \$8,000.

1—Symond (Nordberg) 3' x 12' screen.

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Lorain-L820-New-2 Yard

combination shovel and dragline. This machine has never been used. Can be bought at a great saving.

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SPECIAL POWER SHOVEL VALUES

1. NEW 3/4 Yd. Crane, Shovel Dragline, truck mounted. Powered with 4 Cyl. "La Rat" Gas Engine. Special Built from the latest power shovel design. Part . . . Manoeuvrable . . . Ideal for Contractors, etc. . . With or without truck.

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Real Bargains—Will Sacrifice for Quick Sale.

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30 ton Plymouth gas locomotive

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1/2 yd. shovel attach. Bucy-Erie 15B

Pullahovel attach. for N. West 104

25 ton industrial loco, crane, gas

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STEEL for TEMPORARY USE

BEAMS—ANGLES—PILING CHANNELS—PLATES

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SCOPMOBILE—fork lift truck and charging bucket, powered by Chrysler Ind. engine—pneumatic tires—guar. to be in good condition. \$1,500.00

CRUISER—Bartlett & Snow—24"x36" double roll—excellent condition—complete with motor, starter, switch, spare segments, gears, bearing, springs, housing and belt—guaranteed. \$1,500.00

Roller—rd. 40 h.p. vertical—auto, water feed, gauge, steam pipe—tube and grate very good cond.—coal fired. \$500.00

Magnetic Pulley—18" permanent magnet—pulls tramp iron through 5/8" rubber belt. \$300.00

Complete Jitterate 27 Cylinder Block Plant—all motors, etc.—guar. to be in good condition (will consider any reasonable offer).

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1-10" 250 HP, Diesel Dredge, new approx. '42, 17' wide x 37' long, \$9950.00.

1-12" Portable 700 HP Elec. Hyd. Dredge, practically new, used on 2 jobs only, 6 actions, overall size 24x70, 1/4" plate—4000' of 12" new pipe, 50 steel pontoons, cost \$250,000.00, Darrick, 4 1/2" ton, new SHF leg, 80' boom \$1950.00. Steam Dipper Dredge & Tender, 7 yd. cap., \$45,000.00. Terms. Open for offers. Photo & details on request. 8"-12"-14"-18" Available, portable and standard.

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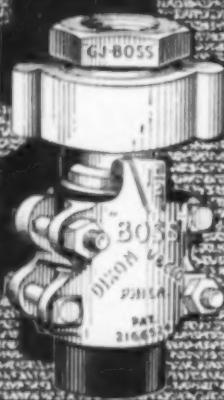
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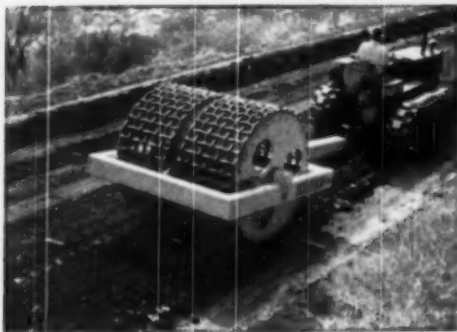


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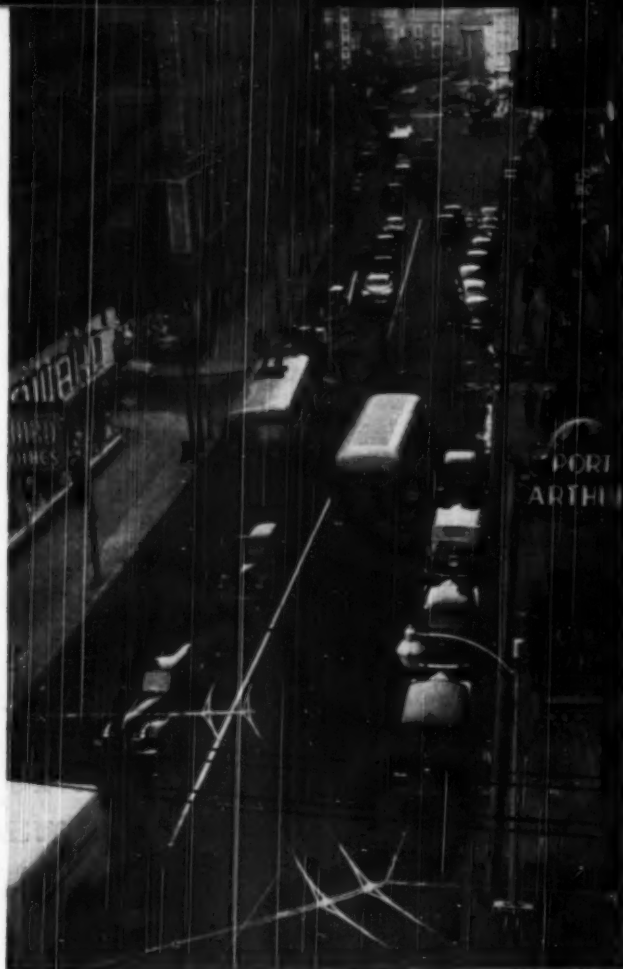
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